



Tale of Two Years: Monitoring Wedge-tailed Shearwaters at Freeman Seabird Preserve in Black Point, O'ahu.

by K. David Hyrenbach, Ph.D. Assistant Professor of Oceanography, Hawai'i Pacific University, khyrenbach@hpu.edu

One of the most common Hawaiian seabirds, the Wedge-tailed Shearwater ('Ua'u kani), is a medium-sized petrel with a wide-ranging distribution through the tropical Indian and Pacific Oceans, and an estimated population of approximately 5.2 million birds (Brooke 2004, Onley and Scofield 2007). The species nests throughout the Hawaiian Archipelago, from Kure Atoll in the north to the offshore islets of Maui in the south, with a total estimated population of 270,000 pairs. While the majority of the population breeds in the Northwestern Hawaiian Islands, an estimated 40,000 to 60,000 pairs nest in the Main Hawaiian Islands, with the larger colonies at Lehua, Ka'ula, Kaena Point (O'ahu) and offshore islets off O'ahu (Manana and Moku Lua). Smaller colonies occur at Kaua'i, Molokini and offshore off O'ahu and Maui (USFWS 2005). Though this species is not taken by longline fisheries, like many other petrels, it is impacted by introduced mammalian predators (i.e., rats, cats) and by human development and encroachment of their colonies (i.e., trampling of burrows, light pollution) (USFWS 2005). Thus, despite the ongoing need for monitoring of colony counts and population trends, the species is not considered at risk by the U.S. Endangered Species Act (ESA) or by the International Union for the Conservation of Nature (IUCN) (USFWS 2005, BirdLife International 2009). Wedgies are commonly encountered at-sea over schools of skipjack tuna (*Katsuwonus pelamis*) in spring – summer (March – September) and can be readily seen from shore commuting to and from their breeding colonies in the early morning and the evening.

Wedgies are also becoming increasingly conspicuous in O'ahu, thanks to several conservation efforts to control introduced predators and to rehabilitate native vegetation. The construction of the Kaena Point predator proof fence will benefit wedge-tailed shearwaters breeding at this site, by protecting them from rats, cats, dogs and mongooses. At Black Point, a small wedge-tailed shearwater colony persists in a residential neighborhood on the south shore of O'ahu. As the result of a generous and unprecedented donation of coastal land in the fall of 2007, the Hawaii Audubon Society established the Freeman Seabird Preserve on a one-acre parcel at the southern tip of Black Point. The Preserve encompasses a flat area near the road and a sloping sea cliff composed of aging lava boulders near the top and limestone deposits at the waters' edge. The site supports between 78-106 active nests, according to colony-wide counts in July of 2009 and 2010. The Hawaii Audubon



Society is working to enhance the nesting habitat and to restore the unique native dry land coastal ecosystem on the upper, flat portion of the Preserve with a multi-stage landscaping plan and the introduction of native Hawaiian plants. Dedicated volunteers work to remove invasive plant species, care for the new biota, and maintain the existing rodent control stations.

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Table 1. Comparison of inter-annual wedge-tailed shearwater phenology and provisioning.

		2009	2010
Hatching Date	sample size	21	29
	mean	Aug. 13	Aug. 19
	range	Aug. 4–28	Aug. 1–Sept. 8
Peak Chick Mass (grams)	sample size	19	21
	mean	447	483
	range	515–325	575–360
Final Chick Mass (grams)	sample size	19	21
	mean	379	383
	range	495–280	475–210

A monitoring program was started, alongside these habitat restoration efforts, to determine whether the shearwaters are benefiting from the revegetation and predator control. Colony-wide counts in early September, after the peak hatching date, have yielded increasing numbers of nests over the last three years: 64 (2008), 76 (2009), and 88 (2010). However, because the reproductive success of shearwaters is influenced by year-to-year changes in oceanographic conditions, monitoring the breeding phenology and chick growth rates throughout the breeding season provides a more insightful perspective of shearwater population responses.

To this end, students from Hawai'i Pacific University (HPU) have collected information on breeding phenology, chick mass, and reproductive success at this site for two years. Each year, we searched for nests as part of a colony-wide count and marked 31 nests (in 2009) and 33 nests (in 2010), respectively. We tracked these nests from July 14 through December 14, and recorded the fate of the eggs and the chick weights on a weekly basis.



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850 Richards Street, Suite 505

Honolulu, HI 96813

Phone/Fax: (808) 528-1432

E-mail: hiaudsoc@pixi.com Website: www.hawaiiiaudubon.com

Pacific Fisheries Coalition (PFC) (a project of HAS)

Tel: (808) 262-6859 Website: www.pacfish.org

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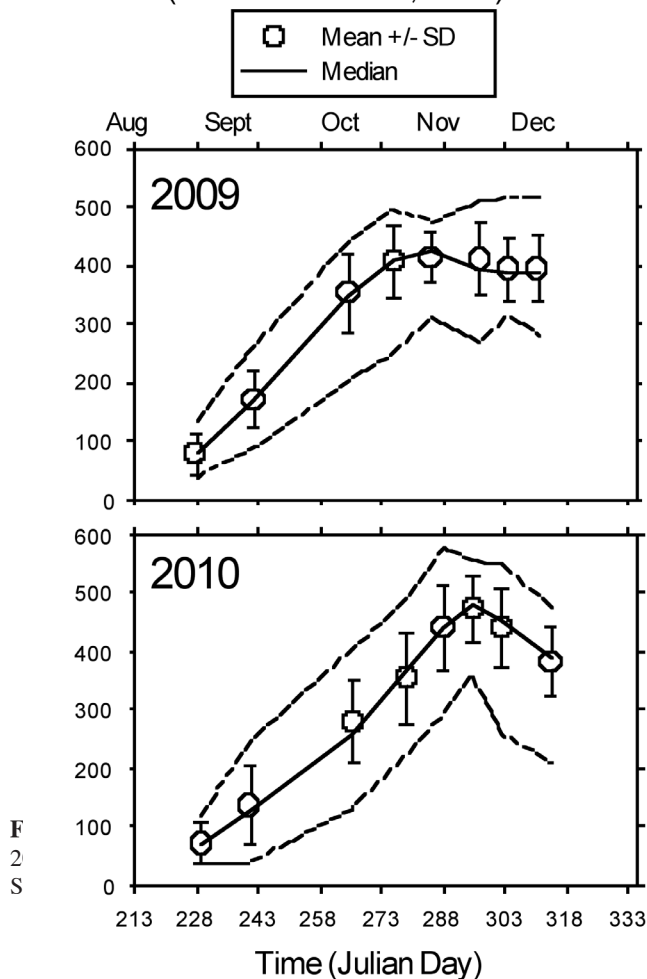
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Wedge-tailed Shearwater Chick Mass (Freeman Reserve, Oahu)



In 2009, the overall reproductive success was 67.7%: hatching success was 71.0% and fledging success was 95.4%. In 2010, the overall reproductive success was 72.6%: hatching success was 87.8% and fledging success was 82.7%. Overall, 55.5% (5 of 9) and 25.0% (1 of 4) of the eggs lost in 2009 and 2010, respectively were predated. Yet, the majority of the eggs lost during the incubation period (7 of 13) could not be retrieved and examined for evidence of predation. Thus, these estimates likely underestimate egg predation rates at the site.

The chicks hatched in early August and fledged in early November, a pattern similar to the breeding phenology at Kilauea Point and O'ahu offshore islets. Chick mass increased linearly until October, when they attained their maximum weights, and then leveled off and declined (Figure 1). The magnitude of this mass loss, which is attributed to the decline in feeding rates from adult provisioning, varies across colonies and years (Whittow, 1997).

The median hatching date was significantly later in 2010, compared with 2009 (t test with pooled variance, $df = 48$, $t = -2.640$, $p = 0.013$). The hatching date was delayed by six days from August 13 (mean date: 225.69 ± 7.29 SD) in 2009 August 19 (mean date: 231.57 ± 8.39 SD) in 2010. These dates are consistent with published reports for the species in Hawai'i,



where eggs begin to hatch in late July, hatching peaks between August 1–12, and most eggs hatch by August 18 (Whittow, 1997).

The chick weights were significantly different during the two study years. While the final weight measurements

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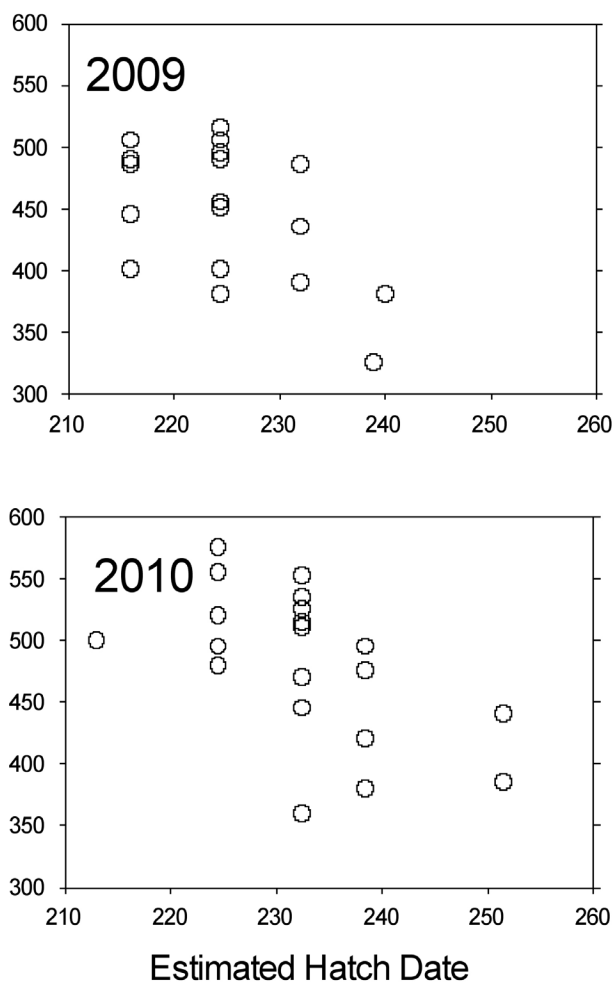


Figure 2: Maximum mass of wedge-tailed shearwater chicks measured repeatedly during the 2009 and 2010 breeding seasons (July – November) were lower for individuals that hatched later. There was also a significant year difference, with lower peak masses in 2009.

(collected in November 9, 2010 and November 6, 2010) did not vary (t test with pooled variance, $df = 38$, $t = -0.211$, $p = 0.834$), the maximum weights attained by the chicks were higher in 2010 (t test with pooled variance, $df = 48$, $t = -2.290$, $p = 0.028$) (Table 1). Because the maximum and final (fledging) weights vary across colonies and from year to year (Whittow, 1997), they provide metrics for assessing resource provisioning to shearwater chicks during the breeding season. Yet, because chicks go through an initial linear weight gain, followed by a period of stagnation or mass loss, the interpretation of these metrics is enhanced by incorporating information on breeding phenology. When we compared the peak mass of individual chicks as a function of their estimated hatch date, we detected a significant decline (chicks hatched later attain lower maximum masses) and a significant difference across the two years. Hatching date was highly significant ($t = -3.959$, $p < 0.001$) as well as the “year” co-variate term ($t = -3.815$, $p = 0.001$). Overall, the best-fit linear regression explained 33% of the variance in peak chick mass across the two study years (Figure 2).

These results suggest that the breeding phenology and chick provisioning of the Freeman Preserve wedge-tailed shearwaters was influenced by inter-annual variability in the marine environment. The two study years were different in an oceanographic context: 2009 was characterized by warm-water El Niño conditions and 2010 was a cold-water La Niña year (see ENSO resources links). While wedge-tailed shearwater responses to ENSO variability have been documented previously (e.g., Peck et al. 2004), it is fascinating that we were able to detect this oceanographic signal at the Freeman Seabird Preserve. This result underscores the importance of understanding varying regional oceanographic conditions when assessing seabird responses to local habitat restoration and predator control efforts. Furthermore, this monitoring

program highlights the value of the Freeman Seabird Preserve for educating students and the public about wedge ecology and conservation. Hawai'i Audubon and HPU will continue to document year-to-year changes in shearwater numbers and productivity at this site, and will use this information to stimulate public awareness and stewardship for seabirds and habitat conservation on land and at sea.

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ENSO Resources

Multivariate ENSO Index (MEI) web-page:

<http://www.esrl.noaa.gov/psd/people/klaus.wolter/MEI/mei.html>

El Niño / Southern Oscillation (ENSO) Diagnostic Discussion web-site: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensio_advisory/

Hawaii Audubon Society Awards for Student Research at the 54th Hawaii State Science and Engineering Fair

Wendy Johnson, Education Committee Chair

The Hawaii Audubon Society presented two awards for outstanding research relating to Hawaii's natural history at the 54th Hawai'i State Science and Engineering Fair held at the Hawaii Convention Center. In late March representatives of the Hawaii Audubon Society's Education Committee joined other agency judges in viewing the exhibits and interviewing students on the subject of their original research.

T'ini Kahakalau, who is a senior at Kanu o Ka 'Aina Charter School in Hilo, received the HAS Senior Division Research award for her project entitled “Rainfall in Waipio Valley”. T'ini's project is part of her school's broader, long-term study on stream restoration in Waipio Valley, done in collaboration with Bishop Museum and relevant government agencies. Waipio stream volume has been monitored for several years to obtain information about natural fluctuations since water is no longer diverted for use in sugar cane fields. T'ini recognized that accurate rainfall data should be part of the analysis and

found that available measurements from Honokaa and Waimea did not predict rainfall amounts in Waipio Valley. Her school was able to purchase an inexpensive, reliable rain gauge that T'ini monitors on a regular basis. She has studied the variables effecting rainfall and has participated in stream profiling activities. T'ini is in the process of training a younger student at Kanu o Ka 'Aina to continue the data collection and analysis that initiated.

The HAS award for outstanding Junior Division Research relating to Hawaii's natural history went to a project submitted by Natalie Newhouse and Marissa Bryant-Manago, who are eighth graders at Kealakehe Intermediate School. Their project was entitled “Coral Reef Ecology Field Study Comparing Kahalu'u and Kikaua Point Beach Parks”. Using underwater transect lines and grids, Marissa and Natalie counted and identified fish, coral, algae, and urchins at both sites. They also

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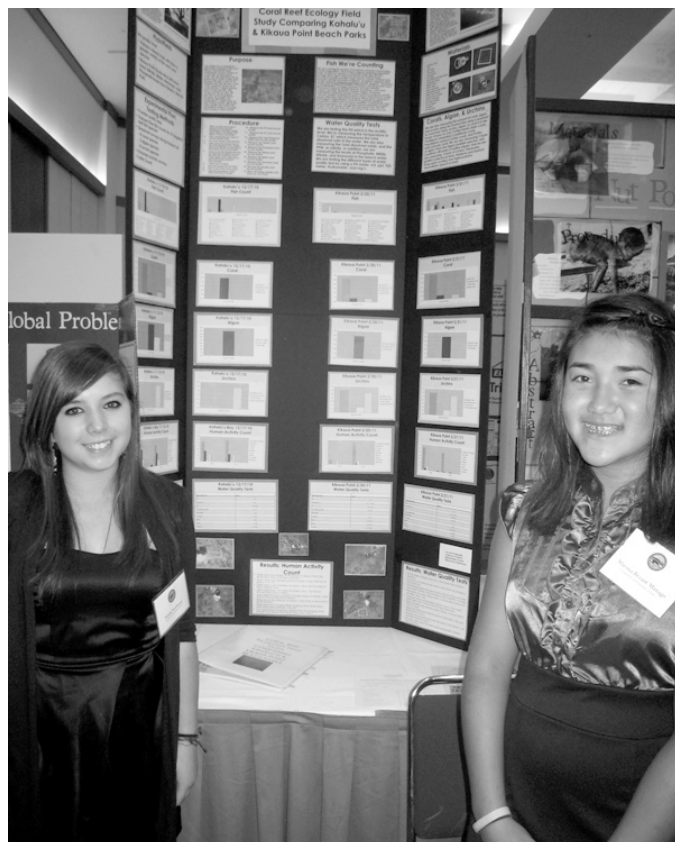
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used test kits to measure a variety of water quality parameters. The students found lower numbers of fish and coral at Kahalu'u Beach Park, even though it is illegal to catch or collect fish there. Fewer people visit Kikaua Beach Park on a regular basis and the waters there had lower levels of dissolved nutrients, along with more flora and fauna.



▲ Tini Kahakalau received the HAS award for outstanding Senior Research relating to Hawaii's natural history.

The HAS award for outstanding research in the Junior Division went to Natalie Newhouse and Marissa Bryant-Manago. ►



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Hawaii Audubon Society Ka'ena Point Wildlife Preserve Field Trip

On Sunday March 27, 2011 the Hawai'i Audubon Society took a hike out to Ka'ena Point Wildlife Preserve on O'ahu. We had 18 participants from Hawai'i, San Francisco and Detroit! It was a perfect, slightly overcast day for our hike and service project. HAS president John Harrison lead the group while HAS secretary Melissa Spreecher was our official DLNR representative.

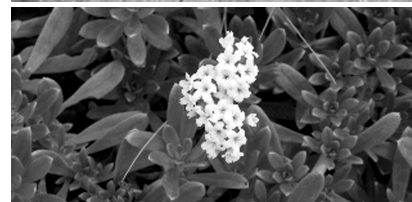
The perimeter fence was almost complete when we went out. Workers were just finishing up so that now the preserve is protected from the spread of invasive plants and predators.

We were able to see many of the native plants that are now beginning to thrive out there, including naupaka, hene, hinahina, po'hinahina, ilima and hi'iaka. We were also lucky to see four Monk seals relaxing at the point and many Laysan Albatross and chicks! It was a great day for seeing wildlife.

On our return we filled at least a half dozen large trash bags with the invasive Milkweed plant and 2 others with trash to complete our service project!

HAS would like to send a huge MAHALO to all of those that joined us, and hope to see you all again soon!

For future trips please check our website www.hawaii-audubon.com or call the office at 808 528 1432. Please feel free to make any suggestions on where we should go next!



Freeman Seabird Preserve Update!

We have just passed the half way mark for our fundraising Drive but we still need your help! Please send any donations to Hawaii Audubon Society .

We spotted our first nesting couple the other day in a location that has reared a chick for the past three years! We hope this year will make Four!!





HAWAII AUDUBON SOCIETY
850 RICHARDS STREET, SUITE 505
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