Quantifying Wedge-tailed Shearwater Road Mortality Along Southeastern O'ahu, Hawai'i (2011-2012)

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Hawai‘i Conservation Conference

July 18, 2013

Oikonos Ecosystem Knowledge (1), Hawai'i Pacific University (2), United States Fish and Wildlife Service (3)
Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife (4)

WTSH in Hawai'i

('Ua'u kani, *Puffinus pacificus)*

- Northwestern Hawaiian Islands (NWHI) = ~ 270,000 pairs
- Main Hawaiian Islands (MHI) = ~ 40,000 - 60,000 pairs

- Causes of mortality – at colonies
  - Predators: rats, cats, dogs
  - Disturbance: trampling
  - Attraction to lights: “fallout”

- Life History:
  - Fledging: Nov. – Dec.
  - Leave burrow at night

Photo by Michelle Hester

Motivation

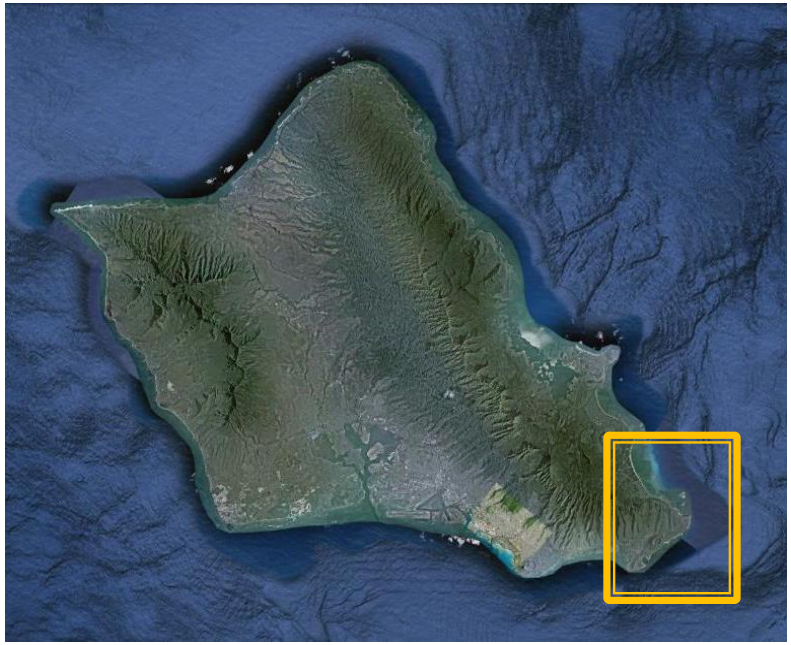
- Goal: Quantify “Fallout”

  Mostly Fledglings (> 90%)

  (Telfer et al. 1987; Le Corre et al. 2002)

- Objectives:
  - Quantify WTSH fallout
  - Estimate WTSH mortality

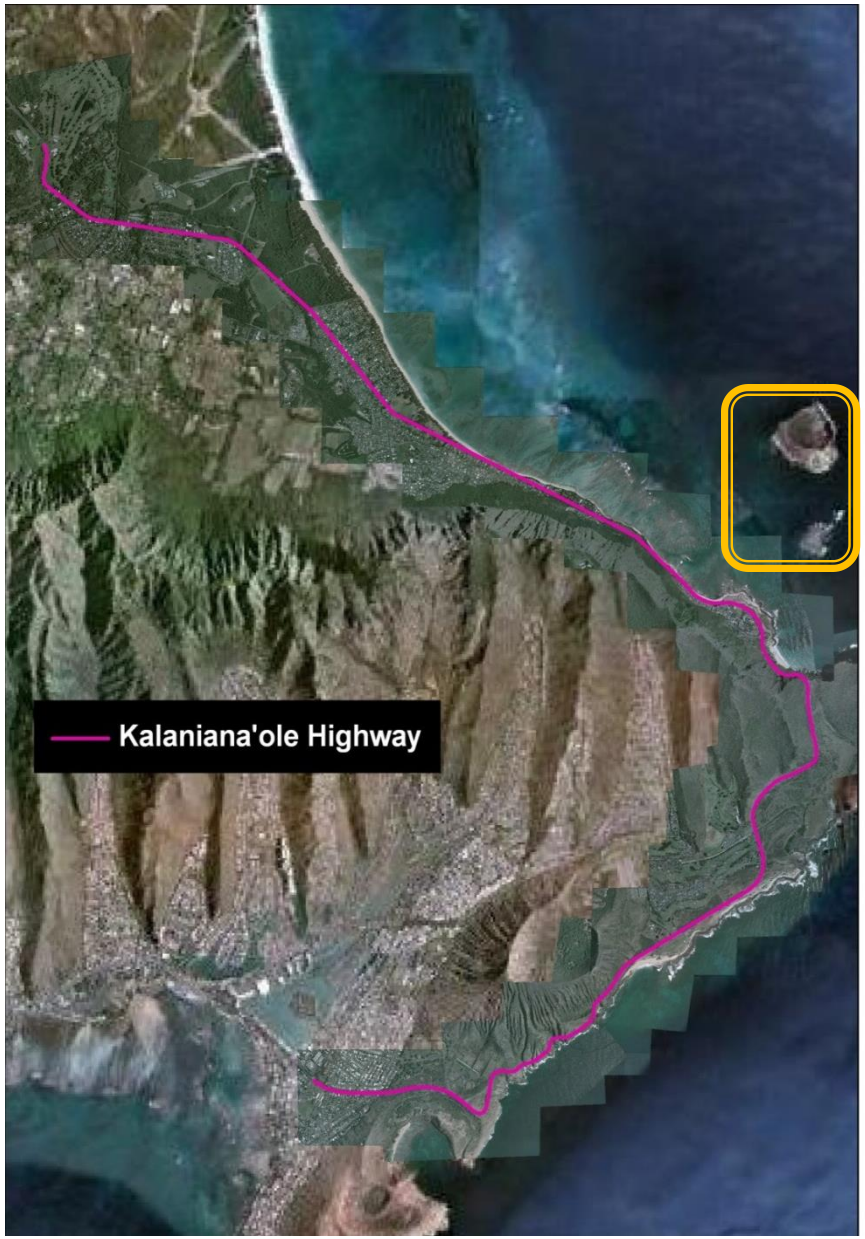
- Predictions:
  - Fallout related to lighting
    - Lunar cycle
    - Anthropogenic lights



Study Area: SE O’ahu

Study Area

- 16.5km Kalaniana'ole Hwy
- Close to upwind colony



Methods - Utility Pole Survey

- Mapped with GPS
- Pole characteristics:
  - Type
  - Height
  - Other attributes

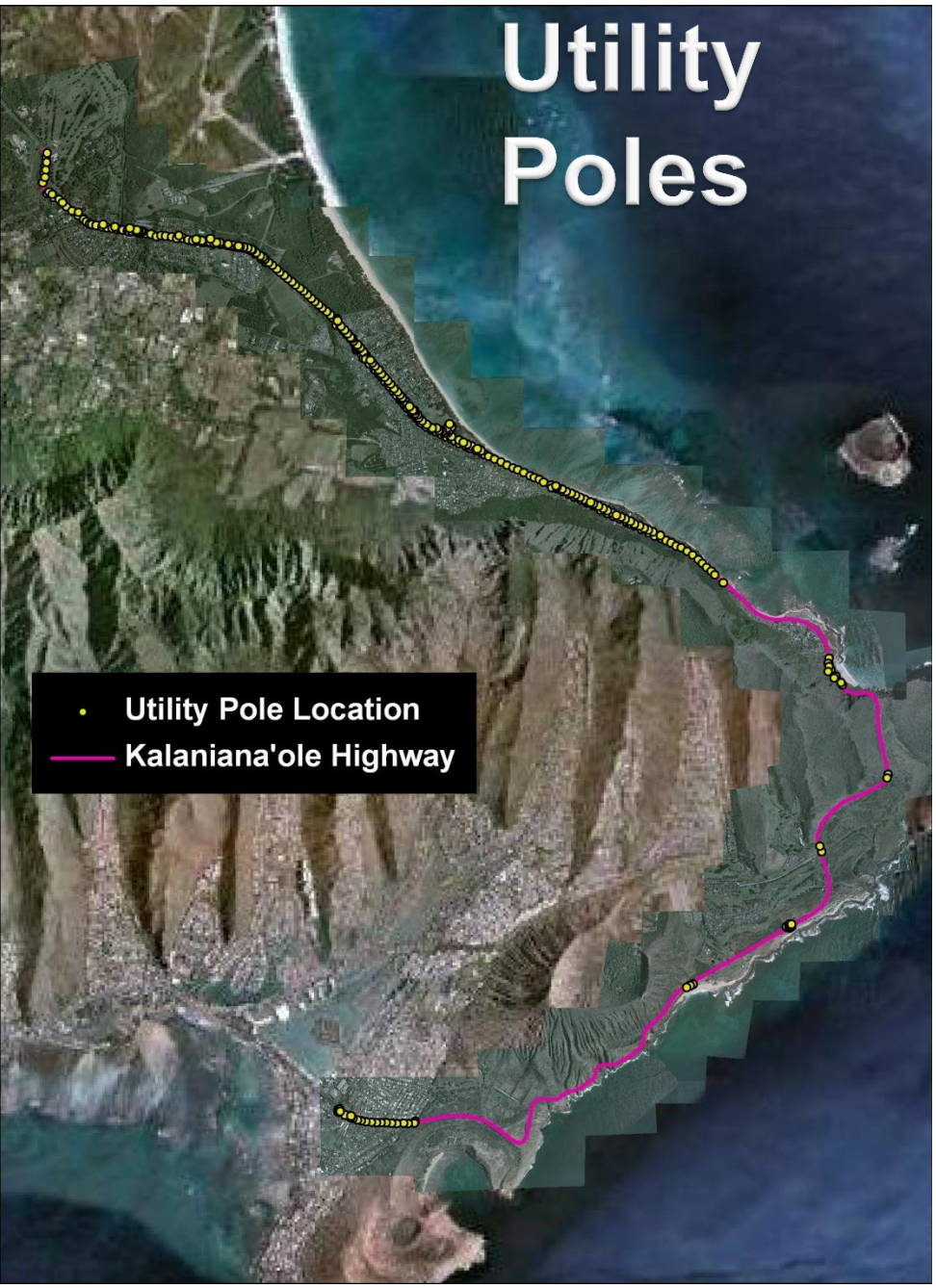
  (power lines, signs, transformers, lights)
- Road attributes:
  - Location of pole, number of lanes

Photos by Devon Francke

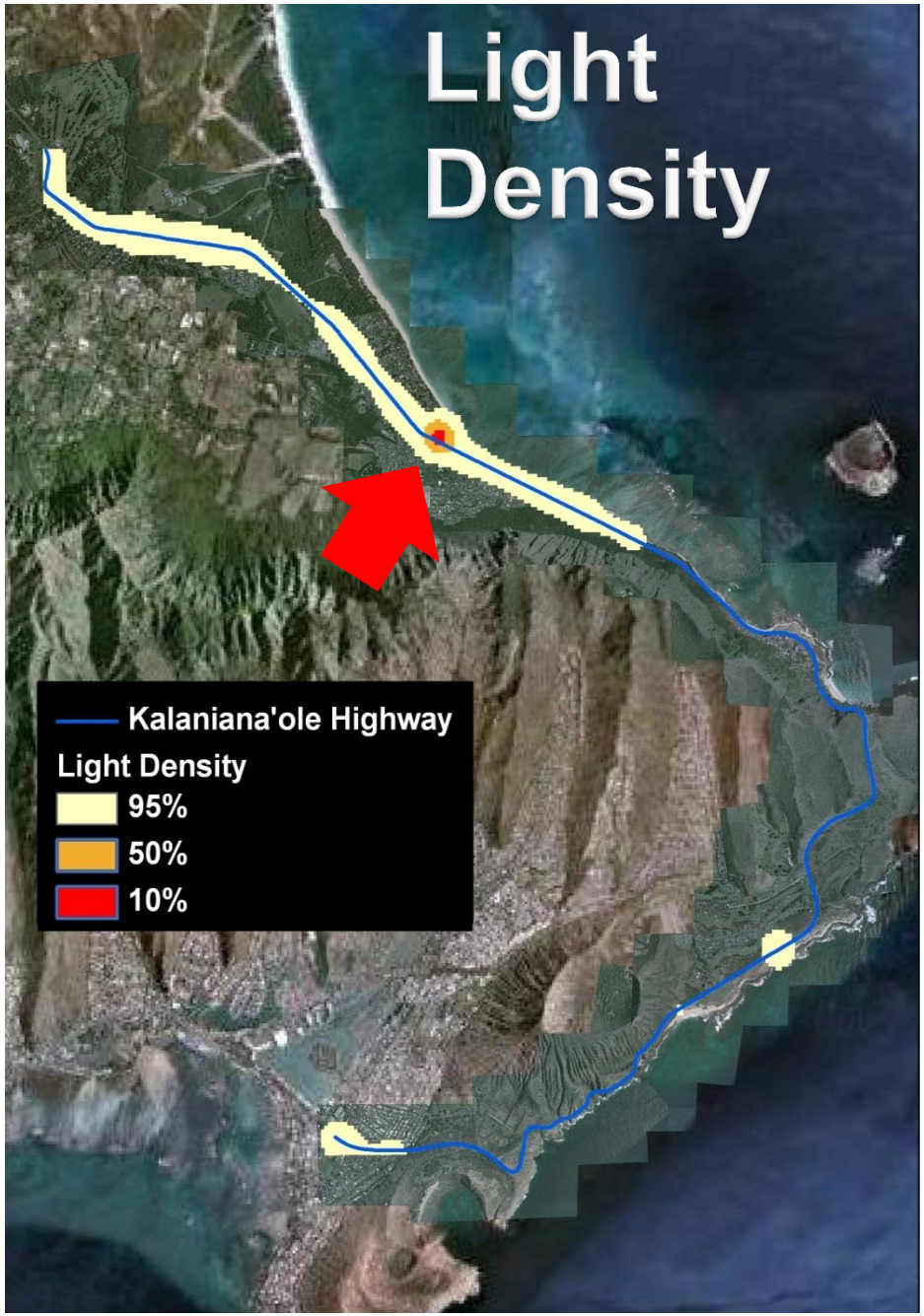
Methods - Fallout Survey

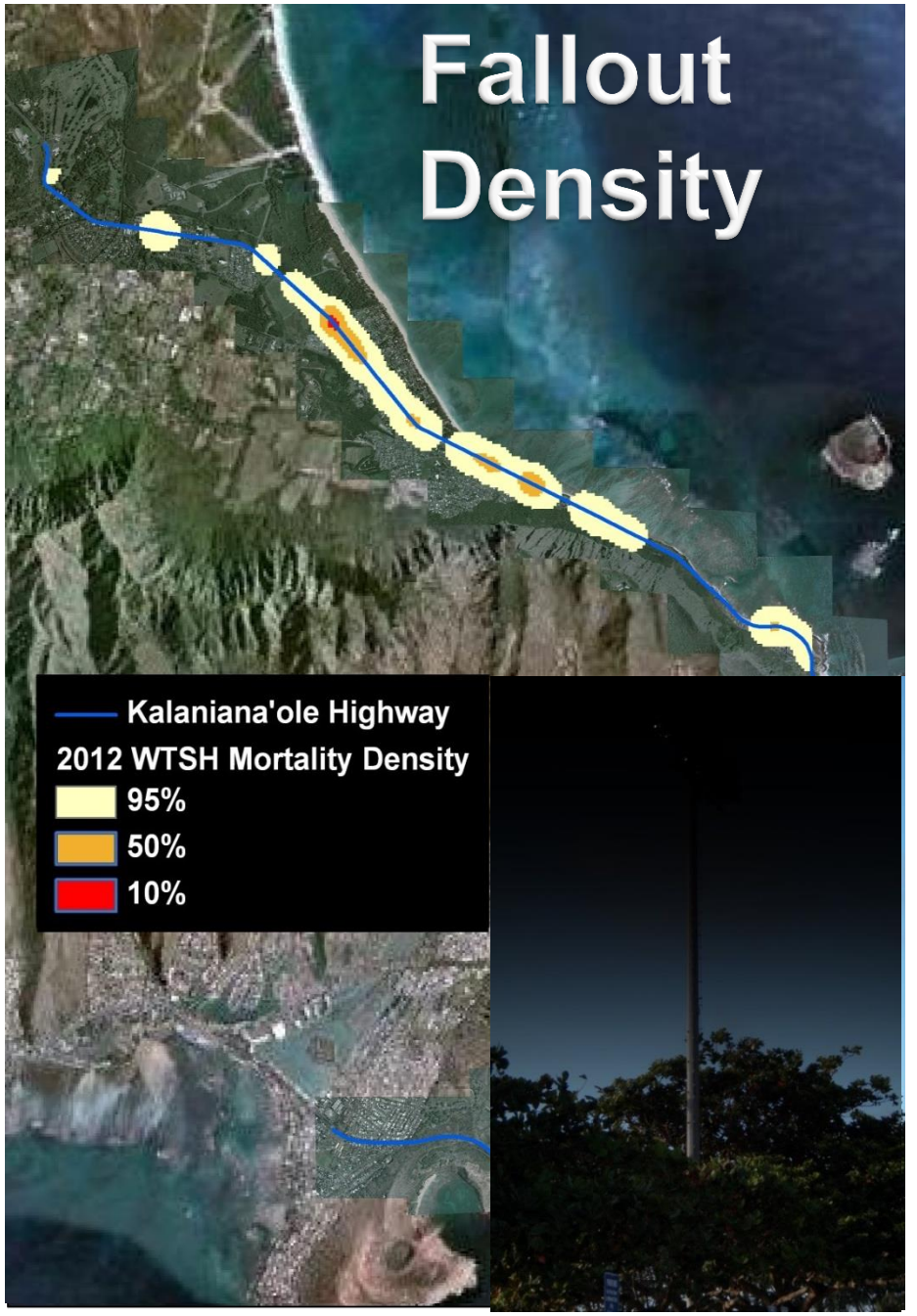
- November- December, 2011-2012
- 17 surveys / year
- Morning: 6:30 - 9:30 AM
- By car (Guinard et al. 2012)
  - Speed: 25 - 35 mph
  - 2 drive-throughs, both sides of road

- Upon encountering fallout:
  - Recorded location, closest utility pole
  - Gathered photographic evidence
  - In 2012 – scavenging trial
    - Randomly selected (n = 40)
    - Marked with string and aluminum tag

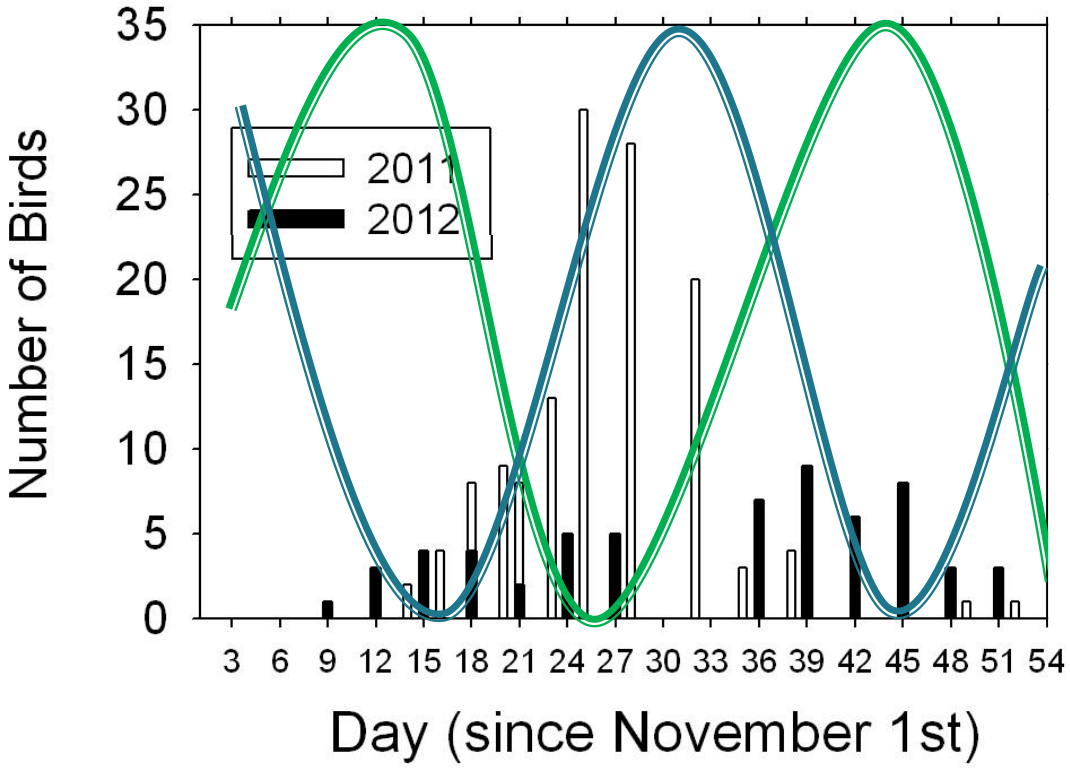

Utility Poles
Utility Pole Location
Kalaniana'ole Highway


Fallout Locations
2012 WTSH Location
Kalaniana'ole Highway
N = 601


Light
Density
Kalaniana'ole Highway
Light Density
95%
50%
10%


Fallout
Density
Kalaniana'ole Highway
2012 WTSH Mortality Density
95%
50%
10%

Results - Moon Effect



2011

http://aa.usno.navy.mil/faq/docs/moon_phases.php

- Generalized Linear Model:
  - $R^2 = 0.376$

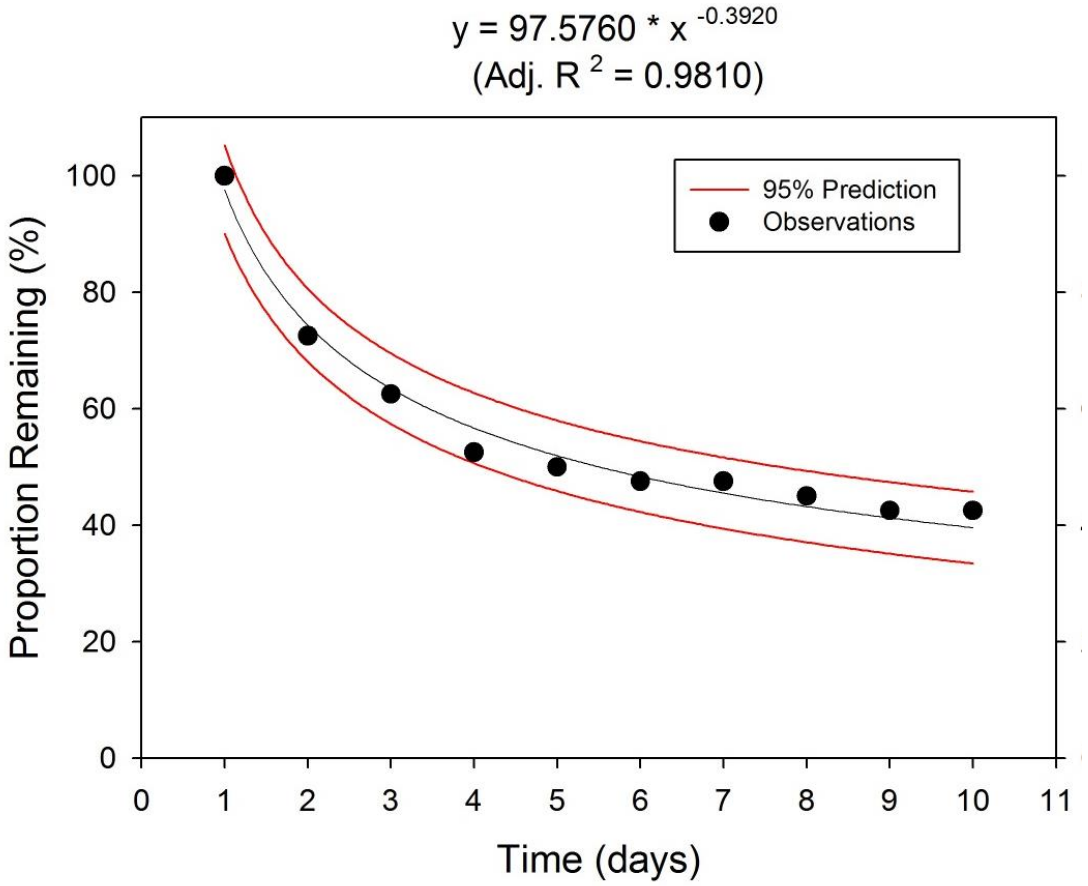
Effect	Coefficient	P-value
Julian Day		
Year (categorical)		
% Moon Illuminated		

- ↑ Moonlight = Fallout ↓
  - Decreases attraction to artificial light? (Reed et al. 1985)
  - Full moon inhibits fledging? (Reed et al. 1985)

Results – Scavenging Trial

Persistence: Weibull Model: time-varying exponential decay

- Older carcasses removed less frequently than newer carcasses
  - Less appetizing: decomposing, encrusted to road (Guinard et al. 2012)



Next Steps

- Ongoing analyses:
  - Model shearwater fallout as a function of utility pole / road characteristics and environmental variables
- Further variables to consider:
  - Wind speed / direction, rain, cloud cover
- Fallout survey: Nov-Dec 2013
- Work with resource managers and DOT / HECO to minimize fallout

Photo by Michelle Hester

Acknowledgments

- Keith Swindle (USFWS) started fallout surveys

- Funding provided by the State of Hawaii Division of Forestry and Wildlife (DOFAW)

- State of Hawaii Department of Transportation

Photo by Michelle Hester

Questions?

Fallout Mitigation

- Rescue campaigns
  - Increase vigilance during fledgling season (Rodríguez et al. 2012)
  - >90% release rate (Telfer et al. 1987; Le Corre et al. 2002; Fontaine et al. 2011)

- Minimize effects of artificial lighting (USFWS 2005)
  - Shielding: Newell's shearwater fallout on Kauai down by 40% (Reed et al. 1985)
  - Restrict light use during peak of fledging season (Telfer et al. 1987; Le Corre et al. 2002)

http://www.kauai-seabirdhcp.info/minimization/lights/

Light and Fallout Density

- Mortality rates of other procellariiformes
  - Tenerife, Canary Islands: 45-61% of Cory's shearwater (Rodríguez and Rodríguez 2009)
  - Reunion Island: 20-40% of Barau's petrels (Le Corre et al. 2002)
  - Kauai: > 50% of the endangered Newell's shearwater (Reed et al. 1985)
- Mechanism attracting birds to light poorly understood (Verheijen 1985; Troy et al. 2011)
  - Bioluminescent squid? (Imber 1975)
  - Navigation by starlight / moonlight? (Reed et al. 1985)

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