# Station #1
# Hawaiian Hoary Bat (*Ope‘ape‘a*)


One of only two **native** mammals in the Hawaiian Islands

A small nocturnal bat species (weighs only ½ an ounce, wingspan of 12 in.)

Feeds on flying insects in forestlands and coastlines

Closest relatives live in **North America**

Its mainland cousins are able to store fat in their bodies for **continental migrations**

Federally listed as an endangered species in 1970

*Ope’ape’a* means “half-leaf”, referring to its wings which look like half of a taro leaf

# Station #2
# Hawaiian Freshwater Gobies (*O‘opu*)


Five species of native **o‘opu** inhabit Hawaiian streams

Similar gobies live in the South Pacific, the Americas, Africa, and Southeast Asia

Hawaiian gobies are **amphidromous**, meaning they live in the ocean as larvae and juveniles

O‘opu larvae can spend **3-6 months** living in the ocean

The larvae can spread from island-to-island through **oceanic currents**

When they find an appropriate location to settle, the juveniles begin migrating upstream

Some o‘opu can use their strong pelvic fins to climb up waterfalls

# Station #3
# Hawaiian Tree Snails (*Kāhuli* snails)


**Tree-dwelling snails** are found on most of the Main Hawaiian Islands

Similar snails are found in the **South Pacific**

Their **shells** provide them with protection from the elements

However, these are **land snails**, and **will not survive in salt water**

Snails have a **muscular foot**, which they can use to attach themselves to most surfaces

Many species have already gone extinct, and all surviving species are **endangered**

# Station #4
# Gecko (*mo‘o*)


There are **nine gecko species** present in the Hawaiian Islands

Geckos can be found in a variety of ecosystems around the world

Some geckos are well-adapted for living in human-dominated environments like cities

Most species are **small**, and are capable of hiding within tree trunks or under rocks

The mourning gecko, found throughout the Pacific Ocean, lays **saltwater-resistant eggs**

Some species can reproduce **asexually**, or without a mate

Certain Hawaiian families consider the gecko, or **mo‘o**, their **‘aumakua**

# Station #5
# Brush-tailed Rock-Wallaby


Brush-tailed rock wallabies are **native** to the dry forests of southwestern **Australia**

In Hawaii, these wallabies are only found in certain valleys in south-central O‘ahu

Today, wildlife experts estimate there are **less than fifty** wallabies in the area

Wallabies are sometimes kept as **exotic pets**

Brush-tailed rock wallabies are **herbivores**

Like their larger relatives the **kangaroos**, wallabies are **marsupials**

# Information Sheets for Teachers

**Hawaiian Hoary Bat (opeʻapeʻa)** – The most plausible colonization scenario for this species is that some North American hoary bats (*Aeorestes cinereus*) were blown across the Pacific Ocean to the Hawaiian Islands in strong storm winds. The fat storage reserves in this species may have allowed these initial colonizers to survive the airborne journey across the sea. Upon arriving in Hawaii, the bats thrived off of native flying insects. Due to the isolation of the Hawaiian Islands, the population diverged from the mainland stock, leading to speciation and the emergence of the endemic Hawaiian hoary bat species (*Aeorestes semotus*). Recent genetic analyses of hoary bats in Hawaii suggest that there were **two** distinct colonization events: one approximately 1.3 million years ago and another as recently as 10,000 years ago.

**Citation**: Baird, Amy B., et al. "Nuclear and MtDNA Phylogenetic Analyses Clarify the Evolutionary History of Two Species of Native Hawaiian Bats and the Taxonomy of Lasiurini (Mammalia: Chiroptera)." *Plos One*, vol. 12, no. 10, 2017, doi:10.1371/journal.pone.0186085.

**Hawaiian Freshwater Gobies (oʻopu)** – The ancestors of the five Hawaiian freshwater gobiids likely arrived in the Hawaiian Islands as planktonic larvae in oceanic currents. The gobiid families that our native oʻopu belong to are found in the West and South Pacific, indicating a general west-to-east directional trend to the colonization process. All five Hawaiian oʻopu belong to separate genera,

indicating unique speciation timelines for each colonizing species. Over time, reproductive isolation and selective environmental pressures led to the evolution of the five endemic species observed today. Interestingly, there are no island-specific endemics among our oʻopu, and little evidence of genetic structuring within each species. This implies that oʻopu larvae are distributed evenly throughout the Hawaiian Islands via inter-island oceanic currents.

**Citation**: Mcdowall, R. M. "Hawaiian Biogeography and the Islands' Freshwater Fish Fauna."*Journal of Biogeography*, vol. 30, no. 5, 2003, pp. 703–710., doi:10.1046/j.1365-2699.2003.00851.x.

**Hawaiian Tree Snails** – The origins of our Hawaiian tree snails are still somewhat ambiguous; however, evolutionary biologists theorize that the ancestors of our native tree snails were much smaller than the snails we observe today. These diminutive gastropods may have attached themselves to roaming birds using their muscular feet, and could have colonized the Hawaiian Islands as a "stowaway" on the finch-like ancestors of the honeycreepers! Another theory is that a colonizer bird consumed some tree snail ancestors before making the oceanic voyage to Hawaii. A few of these snails could have survived the digestion process, and emerged from the bird's droppings in their new home. Land snail colonization of the Hawaiian Islands via floating rafts of vegetation or storm debris is possible, but unlikely due to the snails' aversion to saline conditions.

**Citation:** Holland, Brenden S, and Michael G Hadfield. "Origin and Diversification of the Endemic Hawaiian Tree Snails (Achatinellidae: Achatinellinae) Based on Molecular Evidence." *Molecular Phylogenetics and Evolution*, vol. 32, no. 2, 2004, pp. 588–600., doi:10.1016/j.ympev.2004.01.003.

BBC Nature article on snails surviving digestion by birds

http://www.bbc.co.uk/nature/14048754

**Geckos** – It is thought that geckos first arrived in the Hawaiian Islands as stowaways aboard Polynesian voyaging canoes. Their small size may have allowed them to hide within the wooden frames of these seafaring vessels or to remain undetected in agricultural materials brought to the islands. Alternatively, the small saltwater-resistant eggs of these species could have theoretically survived the journey from the South Pacific by themselves. Three species were thought to have colonized the archipelago through this process: the stump-toed gecko (*Gehyra mutilata*), the Indo-Pacific gecko (*Hemidactylus garnotii*), and the mourning gecko (*Lepidodactylus lugubris*). At least two of these species are parthenogenic, meaning the entire species is composed of females that reproduce asexually. In this way, a single individual can colonize an entire island. The house gecko (*Hemidactylus frenatus*) was introduced to the Hawaiian Islands in the 1950's, likely through the shipping industry, and has since become the most common gecko seen in developed areas. Subsequent gecko introductions have occurred as a result of the exotic pet trade. Three species of Madagascan day geckos have become established in Hawaii, possibly through intentional release.

**Citation:** McKeown, Sean. *A Field Guide to Reptiles and Amphibians in the Hawaiian Islands*. Diamond Head, 1996.

Clip about the Mourning Gecko and its distribution via Polynesian voyaging canoes

https://www.youtube.com/watch?v=XuDN6nLf5mM&

Recent online article on gecko species in Hawaii

https://sciencing.com/types-geckos-hawaii-6541376.html

**Brush-Tailed Rock Wallaby** – Wallabies are certainly among the most peculiar introduced mammals in Hawaii. The entire Hawaiian population of brush-tailed rock wallabies can be traced back to a breeding pair that escaped from a private collection on O‘ahu in 1916. This elusive species is difficult to observe, with occasional sightings in the Kalihi Valley area. It is unlikely that this introduced mammal has had a large impact on native ecosystems, since their numbers have remained relatively low. It is thought that the wallabies graze on non-native vegetation like Christmas berries, a common introduced plant in dry lowland forests. Wallabies on O‘ahu occasionally fall victim to road accidents and hunting dogs.

**Citation**: Eldridge, Mark D. B., and Teena L. Browning. “Molecular Genetic Analysis Of The Naturalized Hawaiian Population Of The Brush-Tailed Rock-Wallaby,Petrogale

Penicillata(Marsupialia: Macropodidae).” *Journal of Mammalogy*, vol. 83, no. 2, 2002, pp. 437–444., doi:10.1644/1545-1542(2002)0832.0.co;2.

Hawaii News Now overview of recent wallaby sightings in Hawaii

http://www.hawaiinewsnow.com/story/37509525/wallaby-makes-a-visit-to-the-halawa-correctional-facility

http://www.hawaiinewsnow.com/story/10366453/animals-go-wild-the-wallabies-of-kalihi-valley

Latest update on the rescued wallaby in Halawa Valley

http://www.hawaiinewsnow.com/story/37596755/wallaby-captured-in-halawa-undergoes-surgery-at-zoo