



What Are Anchialine Pools?

To understand what an anchialine pool is, you have to look at its individual components, and then consider the whole picture again. Each pool's unique conditions and residents work together to create complex and unique little ecosystems. These biological gems may seem alien to our world, but they are too special to really be from any other planet than our own.

In Young Lava Flows Close to the Coast

Land-locked within young lava flows or rocky limestone-like areas near the coastline, there are pools of brackish water. They form where freshwater moves downslope through porous rock, mixing with sea water moving up from below. But neither water source is visible at the surface. Each pool becomes a laboratory for life with variations in temperature and chemistry because no two pools are alike in shape, distance from the ocean, or underground freshwater sources. Each evolves into a universe unto itself.



Salinity can range from 8-22%. No two pools are alike in all these factors, so living things must adapt to each 'neighborhood' in different ways, and some species become endemic: unique to one Hawaiian island, or even one pool. "Anchialine" means near the sea, but they are not tidepools being re-supplied with saltwater at each high tide, the waves do not splash into them, for now...

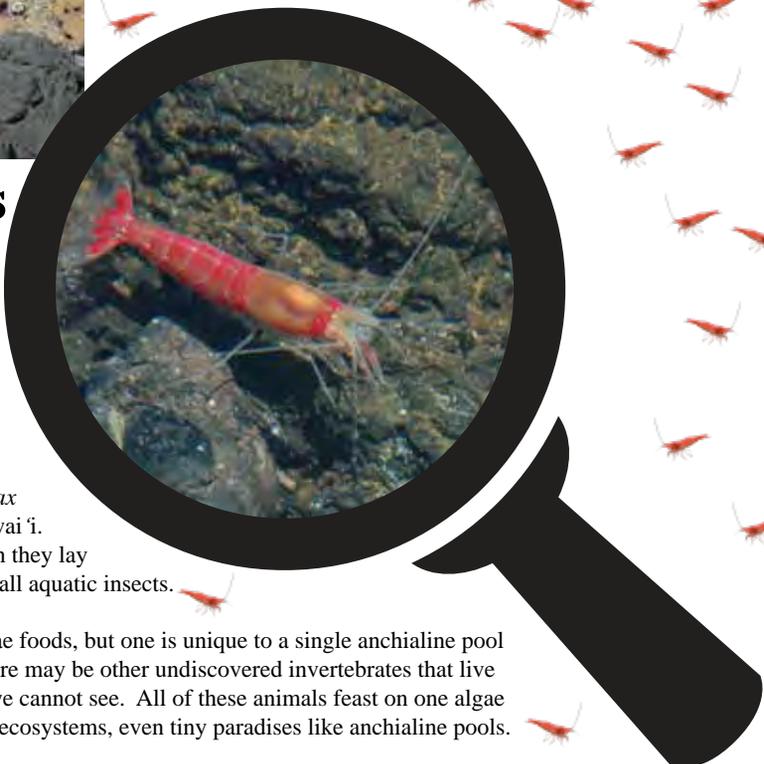


The First to Colonize Are Plants

'Akulikuli (*Sesuvium portulacastrum*) can grow around the edge of a pool. Just below each pool's surface grows a primitive cyanobacteria that can photosynthesize called *Schizothrix*. It is a blue-green alga, but in anchialine pools it forms thick yellow-orange mats as it lays down calcium carbonate it pulls from the sea water. Other cyanobacteria make brown, tan and grey mats, with colors often painted together in swirling, blossoming patterns. Deeper pools can host green algae at 15 down to 20 feet, followed by red algae below that. Some pools have the right substrate for green seagrasses, or even a rare *Ruppia maritima*, an underwater flowering plant. All of these are rich feeding grounds and homes, if you are the right kind of critter.

Enter the Invertebrates

The general Hawaiian name for anchialine pools is *loko 'ōpae 'ula*: it literally says this is where the little red shrimp or 'ōpae 'ula, live. At last count, there are ten known species, five are endangered and the largest is barely an inch. The smaller species can range from yellow to green to translucent. Feeding on the algal mats and debris that collects there, they keep the mats clean and disease-free. It takes patience to see these tiny farmers, but their bright colors and quick movements give them away. Other red inhabitants are adult *pinao 'ula*, (*Anax strenuus*) an orange-black damselfly that is endemic to Hawai'i. Adults feed on flying insects attracted to the water, and then they lay their eggs in the water where their larvae can hunt other small aquatic insects.



Several species of marine snails cruise and scrape their algae foods, but one is unique to a single anchialine pool in Kona, and on Maui, there is a semi-freshwater crab. There may be other undiscovered invertebrates that live their entire lives in water-filled lava crevices deep, where we cannot see. All of these animals feast on one algae or another, but grazers have to worry about predators in all ecosystems, even tiny paradises like anchialine pools.





Fish Commuters

Some pools have unseen ocean connections large enough for young, shallow reef fishes to ‘commute’ through. The pools can be protective nurseries for juvenile fish, places where they can eat species like the shrimps without fear of being eaten themselves. Or can they? These pools can host mid-level predators such as baby eels. Mature eels have even been seen moving short distances over lava rocks from the ocean to a nearby pool and on to others. These predators may come and go with extreme tides. And then there are the threats from the skies...

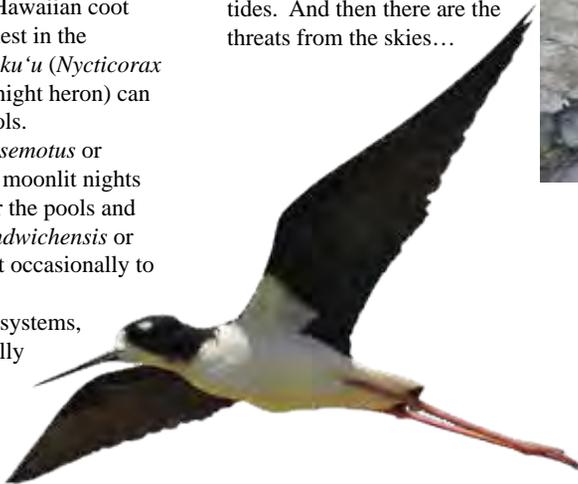


In On A Wing

Migratory shore birds such as ‘ūlīlī (*Heteroscelus inncanus* or wandering tattler), the endemic *ae‘o* (*Himantopus mexicanus knudseni* or Hawaiian stilt) and ‘alae ke‘oke‘o (*Fulica alai* or Hawaiian coot) feed on the invertebrates and even nest in the plants along the pool edges. The *auku‘u* (*Nycticorax nycticorax hoacili* or black-capped night heron) can feed on small fish trapped in the pools.

The ‘ope‘a pe‘a (*Lasiurus cinereus semotus* or Hawaiian hoary bat) can be seen on moonlit nights feeding on the insects hovering over the pools and finally, the *pueo* (*Asio flammeus sandwichensis* or Hawaiian short-eared owl) may visit occasionally to take a bat or young bird for a meal.

So anchiline pools are complete ecosystems, with unique species evolving carefully together through time, below and above the water.



People Are the Biggest Threats

Anchiline pools have delicate water chemistry and the algal mats grow slowly. Just one thoughtless hiker wading into a pool will leave footprints that last decades, and each human footprint is lost foraging space in a little world. One swimmer with soap or sunscreen residues will alter a pool’s chemistry. Human-introduced animals such as goats and deer leave footprints too and often urinate or defecate near a pool, introducing e-coli bacteria and other contaminants. Introduced cats and mongooses hunt native birds. For all these reasons, the anchiline pools of ‘Āhihi-Kīna‘u Natural Area Reserve are open only to school/civic groups who schedule in advance and hike with staff or reserve volunteers.

Climate Change Is Changing Their Future

Hotter and hotter days and longer and longer summers, changing rainfall patterns and rising sea levels are all altering the prospects for this unique ecosystem world-wide, but especially in Hawai‘i. As sea levels rise, will the pools grow in volume, or be swamped from below so often that the algal mats die? As the shoreline creeps inland, we will lose pools close to the water’s edge as they become part of the ocean permanently.



Anchiline pools occur in similar areas on Hawai‘i Island, and in limestone-like formations on O‘ahu but biologists consider the 12 pool groupings in ‘Āhihi-Kīna‘u as the most pristine, the most diverse, and the most intact. Some studies project that in protected areas such as the reserve, there is a chance for survival. Where lava flows are young and untrampled, where native plants are safe from grazers so they can continue to filter the soils, where people do not disturb them, the pools might “migrate upslope” if conditions are right. But they have to have a protected place to go, to migrate into the future.

