APPENDIX ES-5: **HYLAEUS ANTHRACINUS** REINTRODUCTION

ES-5.1 **BACKGROUND**

*Hylaeus anthracinus* is an endemic bee, one of 63 known bee species native to Hawaii. It is found on all islands from Oahu to Hawaii, though there are no recent collections from Lanai and it may be extirpated there (Daly and Magnacca, 2003). The island populations segregate into three strongly divergent genetic clusters (Hawaii, Maui + Kahoolawe, and Molokai + Oahu) that may represent cryptic species (Magnacca and Brown, 2010). It is a candidate for listing as endangered, and will likely be proposed for listing soon (U.S. Fish and Wildlife Service, 2011).

*Hylaeus anthracinus* occurs primarily in the coastal zone. Like other coastal species, it extends into lowland dry forest and rarely montane dry forest. Historically, *H. anthracinus* was widespread along most of the leeward and dry coasts of the islands it inhabits. Between 1930 (when collections of *Hylaeus* largely ended) and the 1990s, the distribution of coastal *Hylaeus* species contracted dramatically (Magnacca, 2007a). On Oahu, Molokai, and Maui, *H. anthracinus* is found in only a few locations. On Oahu, it has been found at a few widely scattered sites, including Ka Iwi in the southeast, Malaekahana and Kahuku in the northeast, and Kaena and Dillingham Military Reservation in the northwest. On Hawaii, it still occurs in several long strips of coastline in South Kohala and North Kona. These populations may reach extremely high densities, but are still restricted to a narrow strip of vegetation consisting of mixed native species and tree heliotrope (*Heliotropium foertherianum* = *Tournefortia argentea*), typically less than 20 m wide, between the ocean and kiawe scrub or fountain grass inland. Elsewhere on the island, only a single very small and vulnerable population is known, at Ka Lae (South Point). There is one record from Pohakuloa Training Area in 2004, but it is a male (Magnacca, 2007b), and it is uncertain if a breeding population exists there or if it may have been a vagrant from the coast.

Several *Hylaeus* species may soon be under management by OANRP, and new techniques will be required for them. The combination of overall rarity and high population density at certain sites makes *H. anthracinus* an ideal species for studying practical conservation techniques. Often 100-300 bees or more may be found flying around a single heliotrope tree in South Kohala, the highest density of any native bee species. This allows for collection of relatively large numbers of individuals without negatively impacting the source population. For this project, we tested the ability to establish new populations of *H. anthracinus* at suitable sites using simple translocation. Establishment of new populations is highly desirable because despite their large numbers of individuals, all existing ones are within a relatively small area and occupy a narrow strip of coastal strand. Stochastic events such as tsunami, fire, or even landscaping changes by shoreline landowners could devastate the populations quickly. The destination site selected was Puuhonua O Honaunau National Historic Park (PUHO), close to historic collection records of *H. anthracinus* at Kealakekua Bay. Although established and primarily managed for its cultural value, the park contains significant areas of native coastal vegetation including a restoration site at Alahaka Bay. In addition, the range of habitat quality available allows for testing of suitability.

ES-5.2 **METHODS**

The translocation was conducted in January 2015. *Hylaeus anthracinus* were collected from *Heliotropium foertherianum* trees at Puako and Waikoloa (approximately 110 and 150 respectively). Those at Waikoloa in particular were heavily male-biased, and extensive catches were made in order to achieve at least a 60-40 male-female ratio among the translocated bees. *Hylaeus* were held in plastic snap-cap vials (approximately 30-50 individuals each) in a cooler bag with ice, and driven to PUHO. Alien bees (mainly *Ceratina* spp. and *Lasioglossum* spp.) were excluded from the catch in the net, and any accidentally included were killed while cooled. Transit time was about 1.5 hours.
Bees were released at three sites at PUHO. These differed in habitat quality; all three are dominated by native plants, but diversity varies widely. In addition, the important introduced floral host Heliotropium foertherianum occurs only at the most diverse site. The sites also varied in the ants present (sampled using corn syrup and salmon cat food baits left out for 1 hour, 10 at each site) – two had Pheidole megacephala, while the third had three species, all of which are considered much less serious threats to native arthropods. Details of the three sites are shown in Table 1. Releases were conducted by simply opening vials and allowing the bees to walk or fly off as they warmed up. Total time from the beginning of collections to the final release was 4.5 hours (10:30 AM – 3:00 PM). The sites were monitored every three months for establishment and abundance. At the coastal trail and royal grounds sites, no bees were seen at the first monitoring period in April, so a second release of 50 bees at each site was conducted then.

**ES-5.3 RESULTS**

The sites were monitored for establishment success in April and July 2015. The weather in April became overcast shortly after arriving and was therefore not conducive to comprehensive monitoring. At least five *H. anthracinus* (three male and two female) were observed on Scaevola and Heliotropium at Alahaka Bay before clouds moved in, but none were seen at the other two sites. During the second release at the royal grounds site, *Pheidole* were observed attacking cold-stunned bees en masse within seconds of them being placed on the ground (Figure 2D). Bees were unable to fend off ants or fly away even after warming up, although they appeared to be unharmed when the ants were removed after being observed for about 10 minutes.

Conditions were better for observation in July, and *H. anthracinus* were seen on Scaevola, Sida and Heliotropium at Alahaka Bay (Figure 2A, B). The last had large numbers (five-minute count: 152), while the others have only a few individuals visiting flowers. Nesting was also observed in coral rock, indicating that the population is established and reproducing (Figure 2C). No bees were seen at the other two sites, but they were found about 150 m north of the Alahaka Bay release site, indicating that they are spreading on their own.
Hylaeus anthracinus is successfully established at PUHO following a single introduction at Alahaka Bay. This is the first time the species has been present in South Kona in about 80 years. A major high surf and high tide event occurred two weeks after the first release, flooding the release sites with several feet of water and causing serious damage to the park. Nevertheless, while this may have affected early nest success, it clearly did not prevent establishment at Alahaka Bay. The primary limiting factor on their distribution in this area appears to be ants – while the middle side (coastal trail) has good quality floral resources, it also has *Pheidole* present. The presence of tree heliotrope (*Heliotropium foertherianum*) may be an important secondary factor. The two cannot be definitively separated, since the current range of *H. anthracinus* extends to the northernmost heliotrope which is close to the southern end of the *Pheidole* population. Nevertheless, it is clear that *Pheidole* excludes bees entirely, and *Heliotropium* is the floral host that supports by far the largest number of *Hylaeus*.

While introduced small carpenter bees, *Ceratina smaragdula* and *C. dentipes*, are present at PUHO, they are not particularly abundant. As at the larger populations in North Kona and South Kohala, *H. anthracinus* appears capable of successfully competing against them in the absence of ants or other aggravating factors. The alien *Hylaeus* recently introduced to Oahu and Kauai, *H. strenuus*, may be another matter; it is nearly identical in size and habit to *H. anthracinus*, which has declined dramatically on Oahu since it became widespread there. Prevention of its spread to Hawaii is therefore of critical importance.

### References


Figure 2. *Hylaeus anthracinus* at Puuhonua O Honaunau NHP. (A) female on *Sida*, concentrating a drop of nectar. (B) Male caught flying around *Scaevola*. (C) Nest entrance in coral rock sealed with cellophane-like secretion. (D) Attacked by *Pheidole megacephala* at the royal grounds site.