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Farallon Islands Cassin's Auklet and Ashy Storm-petrel Habitat Restoration

Progress Report to Cosco Busan Trustee Council and Request for 2023 Funds

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December 2, 2022

In an effort to address the impacts of increasing air temperature and greater frequency of extreme weather events, Point Blue Conservation Science designed, built, and installed a small number of durable "climate smart" nesting habitat for Cassin's Auklets on the Farallon Islands National Wildlife Refuge. Between October 2015 and October 2017, we tested a small number (n=8) of experimental clay modules (dome and shielded "mailbox" design) at 2 sites on the Farallones and observed encouraging results. Support from the Cosco Busan trustee council facilitated the construction and monitoring of 30 additional ceramic auklet nest modules on the Refuge during the summer and fall of 2017. Temperature and occupancy testing of these new nest modules was conducted from the 2018 through 2020 nesting seasons while continuing to experiment with different module designs. Through this effort we developed a large enough sample size to make meaningful comparisons to previous artificial habitat, perform wide scale validation of previous results, and to develop a final climate smart nest module design (Figure 1). The final design modifies the initial mailbox prototype by adding more air holes and more air space between the box and the heat shield to increase airflow, slightly larger interior dimensions to facilitate safe and easy researcher access, and reduced tunnel length. We believe that this final design will help us to achieve our goals of restoring of auklet nesting habitat on the Farallon Islands National Wildlife Refuge and make it resilient to the impacts of warming air temperatures and increased frequency of extreme heat events.

However, there continued to be challenges with a high cost per unit and difficulty scaling up production. To address this challenge, we were able to partner with Oikonos and the California College of the Arts and leverage the information gained from our previous research and development efforts to obtain a large grant from the Wildlife Conservation Society Climate Adaptation fund. This new source of funds allowed us to contract with master ceramicist Andy Brayman at The Matter Factory in Kansas City to semi-automate and scale up production. This resulted in faster production times compared to hand crafting each individual module as we had been doing. It also significantly reduced the cost per unit from approximately $472 per unit to $350 per unit. This allowed us to schedule production of 100 additional new modules. Of

these, 40 new modules were delivered and installed on the Refuge prior to the 2022 breeding season. An additional 30 were delivered to the Refuge in July but were not immediately installed because it was the middle of the breeding season. The remaining 30 have been produced and are awaiting shipment. These 60 additional boxes will be installed prior to the 2023 breeding season.

During the 2022 breeding season, we continued to monitor the new nest modules and test their thermal properties relative to previous artificial habitat. While results of that study are still preliminary, we found that on average, the climate smart clay modules perform as well as or better than shaded wooden next boxes. Specifically, both clay modules and shaded boxes exhibited similar deviation from ambient air temperature with clay modules performing slightly better (Figure 2A). Also of note was the finding that overall nest temperature differed by area on Southeast Farallon Island, likely resulting from differences in exposure to sun (heating) and wind (cooling). Similar results were observed during extreme heat days (when the temperature exceeded 20°C). However, clay modules stayed significantly cooler than shaded wooden boxes in the Carp Shop area during extreme heat days (Figure 2B). This is again likely due to the Carp Shop having the greatest sun exposure (south facing) while also being somewhat sheltered from the prevailing northwesterly winds during the summer. These results demonstrate that the climate smart nest modules perform as well or better than the shaded nest boxes (and far better than unshaded nest boxes), particularly under extreme heat conditions, while also providing more durable and more natural habitat than previous artificial habitat.

Auklets typically take a couple of seasons to find and colonize new nest boxes. One factor that still needs to be evaluated is how auklets respond to the new nest modules in terms of occupancy, site fidelity, and breeding success. Initial results from 2018 indicated that climate smart nest modules were used by Cassin's auklets during the first year they were deployed, but with reduced occupancy rates (50%) than wooden nest boxes (94%). Occupancy, site fidelity, and breeding success data for the new modules deployed at the start of the 2022 breeding season still need to be evaluated. As does longer term site fidelity and breeding success relative to wooden nest boxes. These analyses are currently underway.

In addition, Cosco Busan restoration funds were employed by the USFWS to contract the construction of new artificial ashy storm-petrel habitat at the Farallon Islands National Wildlife Refuge. The project made use of retired concrete pathways on the island and repurposed the materials to build useful nesting habitat. The new structure (dubbed the Ashy Castle) was completed prior to the start of the 2019 breeding season (Figure 3). Point Blue biologists monitored occupancy of the new artificial storm-petrel habitat between the 2020 and 2022

breeding seasons and have employed social attraction methods to entice storm-petrels to visit and colonize the castle. To date, four sites have been occupied by breeding birds and a total of 3 chicks have fledged (1 in 2021 and 2 in 2022).

We request additional funds for the upcoming fiscal year to install and monitor the new auklet climate smart modules for another season (2023) and to complete analyses to understand how changing from wooden nest boxes to clay modules impacts occupancy, site fidelity, and breeding success. We feel that it is important to track these metrics for another year before we make any further large-scale changes to the habitat. In addition, we will continue to monitor storm-petrel colonization of the Ashy Castle, continue social attraction efforts, and monitor the breeding success of any birds that nest in the structure.

Assuming that the results of these analyses show an overall positive benefit for auklets, we will seek to use remaining Cosco Busan Trustee Council funds to complete replacing the remaining auklet nest boxes and implement the full project using nest modules mass produced at The Matter Factory (beginning for FY 2024).

Budget

Monitoring	
Point Blue Salary/Benefits (0.5 mo. Spears)	$ 4,300.00
Indirect Costs (35%)	$ 1,500.00
Monitoring total	**$ 5,800.00**

Figure 1. Final design for the climate smart nest modules (right) next to an old style shaded wooden nest box (left).

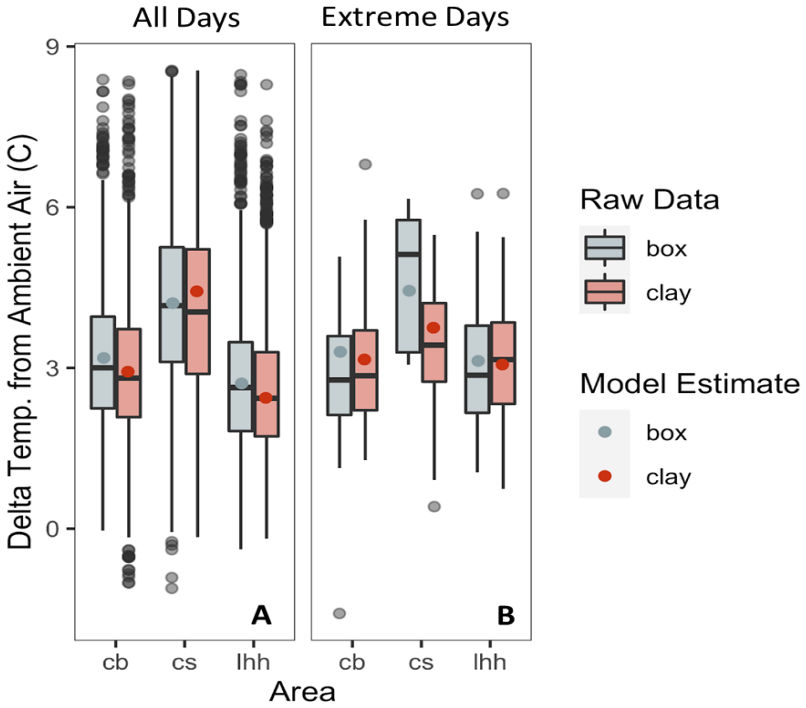

Figure 2. Difference in mean daily temperature of wooden vs. clay nest boxes from mean daily ambient air temperature. Panel A shows data for all non-extreme heat days, panel B data for extreme heat days (≥20°C). Boxplots are clustered by the area the nest boxes were located.

Figure 3. Artificial storm petrel habitat (Ashy Castle) on the Farallon Islands National Wildlife Refuge.