

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Honolulu, Hawaii 96813

September 25, 2020

Board of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

REQUEST FOR APPROVAL TO OUTPLANT A SMALL NUMBER OF CORAL COLONY
MODULES GROWN AT ANUENUE FISHERIES RESEARCH CENTER TO DETERMINE
VIABILITY OF RESTORING DAMAGED AND DECEASED CORAL ASSEMBLAGES AT
HANAUMA BAY MARINE LIFE CONSERVATION DISTRICT, HONOLULU, HAWAII

Submitted for your consideration and approval is a request to outplant six small (under 25 cm) Hawaiian coral colony modules grown at the State's Hawaii Coral Restoration Nursery (or "HCRN") located at Anuenue Fisheries Research Center (or "AFRC") on Sand Island, Honolulu, Hawaii, onto damaged reef substrate located within the shallow water reef flat within the Hanauma Bay Marine Life Conservation District (MLCD), Honolulu, Hawaii. This small, controlled outplanting would help the Division of Aquatic Resources (DAR) determine the viability of restoring various portions of the MLCD where a variety of coral species have died or disappeared over the decades due to high human use, natural events, and most recently, a large piece of marine debris that entered the Bay and destroyed numerous large coral colonies as it washed ashore. The outplanting would consist of six small (<25 cm) corals made up of coral microfragments skinned from Pocilloporid corals from Oahu and re-aggregated into colony modules which have been maintained under high biosecurity conditions for four years at the HCRN and acclimated for outplant conditions similar to those at the Hanauma Bay MLCD shallow reef flat sites. These outplantings will assist the Division to determine whether additional coral restoration at Hanauma Bay MLCD is viable in order to accelerate the return of lost ecological services and functions at this important reef site for the people of the State of Hawaii.

The outplant sites are located upon shallow submerged land makai of the beach fronting the Hanauma Bay MLCD, Honolulu, Hawaii; offshore of Tax Map Key: 390120020000 (Fig. 1).



Figure 1. Hanauma Bay MLCD. Proposed outplanting sites within the shallow reef flat area are shown as yellow/red circles. A total of six (6) small (<25 cm) coral colony modules would be outplanted; three (3) small colonies at each site.

PURPOSE AND NEED:

Data from surveys conducted by University of Hawaii researchers from the Hawaii Institute of Marine Biology, along with earlier surveys by various University researchers over the years has raised concerns regarding potential coral impacts from overuse by visitors in the Bay's shallow waters. DAR coral biologist David Gulko and staff from the HCRN also observed degraded shallow reef habitat during an assessment conducted in July 2020. The Division would like to explore the viability of limited, carefully planned restoration of native corals within degraded areas of the MLCD. The Hanauma Bay MLCD is frequently described by tourism authorities and residents alike as a must-see experience for visitors. Perhaps of greater importance, Hanauma Bay MLCD remains one of the last high biodiversity coral reef systems on Oahu, and the only one with full protection as a MLCD.

The HCRN has spent the last six years developing, testing, and refining both fast-growth coral nursery techniques and outplanting protocols for Hawaiian corals in order to scale-up capability for restoration of Hawaiian coral reefs and the services they provide for our people. As part of

that effort we requested and received permission to use a small site off of Sand Island State Park to test outplant techniques and densities. We have since successfully outplanted numerous large modules within this site with extremely high success rates and survival (Fig. 2). The HCRN has also outplanted extremely rare, endemic corals in Kaneohe Bay and extremely large corals (42-cm and 1-meter) corals off the Reef Runway, Honolulu Airport. To date, the HCRN's success rate with outplanted corals has been 100% survival. There have been no documented negative impacts at any of the three outplant sites from the HCRN corals outplanted to date.



Figure 2. Example of various species of HCRN corals outplanted at a test site off Sand Island State Park. Each module shown is 42 cm in diameter. Note the robust coloration of the outplanted corals and the accretion and growth of the colony module in the foreground, showing it has adapted to its new habitat.

SOURCE MATERIAL:

Source material to grow the six Pocilloporid coral colony modules was derived from coral colony fragments (same genotype each, representing two native species: *Pocillopora meandrina* and *Pocillopora eydouxi*) harvested from the leeward side of Oahu. Each fragment collected was carefully cleaned and then quarantined for a period of at least one month in specialized quarantine tanks at HCRN where they were inspected daily for health, disease, epiphytes, parasites, micropredators, and tissue loss. After clearing quarantine, the source corals were then micro-fragmented and attached to cured concrete forms and fast-grown (Fig. 3) over a period of approximately one year into six small (<25 cm) coral colony modules (Figs. 4 & 5) which then were slowly acclimated to outplant field parameters. All corals spent four years within the HCRN under high biosecurity during this process. No corals to be used were collected from high aquatic invasive species source sites such as Kaneohe Bay or Oahu harbors.



Figure 3. Coral forms with microfragments of coral attached being fast-grown into coral colony modules at the HCRN. Once 100% covered with coral, these coral colony modules will be moved to large acclimation tanks to slowly adjust them to field conditions prior to outplanting.

TRANSPORT:

Pocilloporid coral colony modules (Figs. 4 & 5) would be transported from the HCRN by vehicle to the shallow reef outplant site off the beach at Hanauma Bay MLCD (Fig. 1). Modules will be transported under controlled conditions to maintain acclimation and health of the corals.

OUTPLANTING OF CORAL COLONY MODULES:

The HCRN has already conducted baseline surveys of the target area, and defined two proposed outplant sites (Fig. 1) within the shallow reef flat area that meets our requirements (presence of live corals of the same species in a healthy state, semi-sheltered from extensive human activity, and exposed to appropriate water motion). This proposed outplanting of six coral modules (Figs. 4 & 5) at this site would be monitored by both the HCRN and the Friends of Hanauma Bay to note any initial issues with their survival and health, and follow human use impacts over time. Standard coral outplanting protocol includes transporting the corals in large bins with clean seawater to the outplant site, lowering of each module into the water atop floating baskets to suspend the coral modules subsurface during transport over the reef, followed by slowly lowering the modules onto the ocean bottom by HCRN staff. Divers will prepare each outplant

site with wire brushes to scrape away loose algal surface growth and loose material. Coral epoxy ('Splash Zone'™ 2-part epoxy) will be mixed topside and lowered down to the divers in ziplock bags, who will use it to attach the modules to the bottom in densities of no more than 1 module per m². 'Splash Zone'™ has been used by both DAR and the Maui Ocean Center for coral restoration projects throughout the State over the last decade with no observable negative impacts. Pre- and post-outplant photodocumentation will be taken along with basic data regarding bottom conditions at each outplant site. Divers will outplant all six modules in one outing. All divers will use gloves and follow all DAR diving regulations. Outplanted corals will be monitored for health and survival initially by the HCRN and then transition to the Friends of Hanauma Bay to monitor long term over time.



Figure 4. The three (3) different Cauliflower Coral (*Pocillopora meandrina*) colonies (<25 cm) grown for outplanting at Hanauma Bay in the shallow reef areas as described earlier. All colonies were from the same genotype and grown from microfragments. They have been at the HCRN for four years under high biosecurity conditions and are currently undergoing carefully controlled acclimatization to out plant conditions similar to the shallow reef flat at Hanauma Bay. A fourth colony module (also from the same genotype that was processed at the same time as the others) was outplanted at Sand Island three years ago and is healthy and growing, showing the viability of this approach.



Figure 5. The three (3) different Elkhorn Coral (*Pocillopora eydouxi*) colonies (<25 cm) grown for outplanting at Hanauma Bay in the shallow reef areas as described earlier. All colonies were from the same genotype and grown from microfragments. They have been at the HCRN for at least four years under high biosecurity conditions and are currently undergoing carefully controlled acclimatization to out plant conditions similar to the shallow reef flat at Hanauma Bay.

ADDRESSING POSSIBLE CONCERNS OF OUTPLANTING CORAL COLONY MODULES:

The two Pocilloporid species chosen are both present at the targeted outplant sites within Hanauma Bay itself, and represent common Hawaiian coral species. Pocilloporid corals are characterized by relatively long-duration larvae that can travel considerable distances within the


Hawaiian archipelago, suggesting genetic connectivity amongst the populations. The HCRN corals to be used were specifically chosen due to their Oahu source sites not being within a harbor or within Kaneohe Bay; areas of high aquatic invasive species concerns, pollution and heavy metals.

The HCRN has a long history of being extremely precautionary when it comes to its restoration activities. In creating the HCRN, DAR first ran multiple trials of existing restoration methodology against what we were proposing in order to show its validity and appropriateness for the unique situations here in Hawaii. Prior to conducting any actual habitat restorations using coral from the HCRN, DAR first created an approved test site where we could carefully test each outplant method and type... we did this continuously for over three years prior to even attempting the first coral restoration outplants off the Reef Runway, Honolulu. Since that time, we have conducted successful outplants of corals off Sand Island, off the Reef Runway (at the USN 'Port Royal' grounding site), and in Kaneohe Bay (where we re-introduced an extremely rare coral that had disappeared with the last major bleaching event in 2015). The HCRN is known for incorporating exceptional biosecurity measures into every aspect of its operation; from sourcing corals, to transport, to its extensive quarantine system, its approach towards microfragging of coral tissue, grow-out of large colonies, acclimation of colony modules, and outplanting. Our documented chain-of-custody for both coral tissue and modules is second-to-none and allows for both transparency and confidence in everything we do. Combined together, all of these features make the HCRN uniquely qualified and accountable to conduct this work to help restore the ecological services and functions that the corals in the Hanauma Bay MLCDD provide to the greater ecosystems present. Our proven expertise, exceptional coral husbandry, and dedication to minimizing any environmental impacts through our activities are integral to the Department's role as natural resource trustee for these unique keystone species for the people of the State of Hawaii.

RECOMMENDATION:

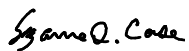
“That the Board authorize and approve the outplanting of six small Pocilloporid coral colony modules as described above, which were raised over four years under high biosecurity conditions at the State’s Hawaii Coral Restoration Nursery on Sand Island, onto shallow water habitat inside of the reef break at Hanauma Bay Marine Life Conservation District. This outplanting and the ensuing monitoring would be used for the Department to determine the viability of conducting restoration of damaged and deceased corals within the marine protected area.”

Respectfully submitted,



BRIAN NEILSON, Administrator
Division of Aquatic Resources

APPROVED FOR SUBMITTAL



SUZANNE D. CASE, Chairperson
Board of Land & Natural Resources