



**Florida Disease Response Coral Rescue and Propagation -  
NSU**



# **Florida Disease Response Coral Rescue and Propagation - NSU**

Final Report

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## Management Summary (300 words or less)

The NSU Onshore Coral nursery is a multipurpose, *ex-situ* onshore coral nursery dedicated to supporting the preservation and restoration of the Florida reef tract. The nursery is a hub for coral nursery activities; housing corals for grow-out/microfragmentation, out planting, teaching restoration practitioners, and providing logistical support for a variety of other reef restoration activities through close collaborations and communication with restoration partners and government agencies. The onshore nursery currently holds 3,993 corals in total; 468 colonies and 3,525 fragments. A total of 461 corals have been out planted and 306 corals have been shipped from the onshore nursery systems since July 2025. Additionally, 125 working animals (snails, shrimps, sea urchins, etc.) have been quarantined for biosecure use, and 7 coral colonies have come ashore for disease treatment/isolation.

## Executive Summary (max 1 page)

The NSU Onshore Coral Nursery's mission is to serve as a multipurpose, *ex-situ* onshore facility dedicated to support the preservation and restoration of the Florida reef tract. The nursery is a hub for coral nursery activities, providing a biosecure space for the care of new colonies, diseased/agitated colonies, and fragment grow-out. The nursery facilities support the restoration activities of other NSU researchers including Dr. Gilliam (NSU), Dr. Walker (NSU), Dr. Lopez (NSU), Dr. Kerstetter (NSU), and Dr. Figueiredo (NSU). Additionally, we provide essential support to agencies such as the National Oceanic and Atmospheric Administration (NOAA) & Florida Fish & Wildlife (FWC). The nursery husbandry team also maintains inter-organization and public communication activities, including interactions with other intermediate holding and AZA facilities, participation in weekly conference calls, and troubleshooting and problem solving through email and telephone conferences with partners. NSU continues to utilize the SEACOR systems as quarantine space for newly arrived corals and maintenance animals (such as sea urchins, shrimps, snails, etc.) that are distributed to other coral rescue facilities as well as the labs within NSU's prevue.

Our primary focus continues to be the care and maintenance for the endemic corals in our systems and support for ongoing coral outplant and transport activities, including acclimation of incoming corals to nursery conditions, direct transportation from collection to other project partners when needed, and short-term housing for corals that are pending transplantation. We continue to improve our onshore nursery facilities, such as enhancing filtration and system water volume, and replacing weather-worn equipment such as pumps and water chillers, to improve our utility and husbandry. This year, significant progress has been made to create an additional 22 independent systems designed to hold and grow corals for rescue and propagation. Additionally, the harsh cold front that swept South Florida this spring highlighted some weaknesses in our heating systems which have since been repaired or improved.

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The onshore nursery currently holds 3,993 corals in total; 468 colonies and 3,525 fragments. A total of 461 corals have been outplanted and 306 corals have been shipped from the onshore nursery systems since July of 2025.

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## **Acknowledgements**

The NSU husbandry team consists of a dedicated group of NSU students and employees who ensure the well-being of corals in the nursery, including Onshore Nursery manager Kyle Pisano, assistant manager Amanda Travers, and current staff aquarists Ellen Skelton, Abbie Wilson, and Megan Quinn. Caring for thousands of corals and more than 30 independent coral culturing systems is no small task, especially when care is demanded 365 days a year.

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## List of Acronyms

AZA = Association of Zoos and Aquariums  
DEP = Florida Department of Environmental Protection  
CRRAM = Coral Reef Restoration and Monitoring Lab  
FWC = Florida Fish & Wildlife  
NSU = Nova Southeastern University  
NOAA = National Oceanic and Atmospheric Administration  
SCTLD = stony coral tissue loss disease  
SSID = *Siderastrea siderea*

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## 1. Description

Since the beginning of this project, naïve and endemic rescue corals have been housed at NSU in the land-based main building nursery (eight 400-gallon raceways and a comprehensive life support system), the SEACOR system (30 individual 120-gallon tanks, each with fully independent filtration and life support systems) and 2 indoor propagation systems (each with two 200-gallon raceways and independent life support systems).

NSU's role in broader coral rescue and reef restoration efforts has been multifaceted. While primarily acting as a receiving and quarantine facility for incoming corals, NSU has also assisted with logistic issues regarding both rescue and non-rescue coral transportation, shipping, supplies, storage needs, and has provided volunteers support for coral receiving, coral shipping, and other miscellaneous tasks and preparations as needed. We have increased our capabilities to hold other corals beyond the scope of the original non-endemic coral field collections. This effort has included both the SEACOR system and the 4,000-gallon main onshore building nursery at NSU; providing both short-term and long-term housing for corals which are, for example, rescued as part of building and maintenance projects, such as costal construction projects around Port Everglades, or corals bound for transplant off the shores of Broward County. The available facilities are unique in terms of the capability to provide ample short-term quarantine care and long-term life support.

The project scope expanded, in collaboration with Dr. Figueiredo, Dr. Walker, and Dr. Gilliam's efforts in coral propagation, to include micro-fragmentation of key reef-building species. Asexually reproducing corals through fragmentation has the advantage of quickly increasing coral biomass available to restoration efforts, but it does not contribute to increased genetic diversity. Fragmentation consists of breaking adult colonies into multiple smaller pieces, which then are grown in land-based and/or offshore nurseries. Smaller fragments present faster growth rates than larger colonies. This has been hypothesized to be because smaller corals allocate more energy towards growth and away from reproduction, or simply because the perimeter to area ratio is more advantageous for the growth of modular organisms. Microfragmentation of reef-building species impacted by the SCTLD outbreak and extreme heat events needs to be optimized and intensified in land-based and offshore nurseries to significantly enhance their density on the reef, enhance fertilization success, and ultimately promote recruitment success.

The overall goal of this project is to provide continuing support for ongoing coral rescue and propagation (via fragments and microfragments) and to provide support for quarantine, as well as resources to support the cumbersome logistics of transporting corals long distance for restoration.

The outcomes of this project will be incorporated into an ongoing coral disease response effort which seeks to improve understanding of the scale and severity of the coral disease outbreak on Florida's Coral Reef, identify primary and secondary causes, identify management actions to remediate disease impacts, restore affected resources, and ultimately prevent future outbreaks. As such, collaboration amongst partners is encouraged when appropriate to avoid duplication of efforts and ensure alignment of needs.

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Coordination with other Principal Investigators is recommended and required, as appropriate.

## **2. Methods**

### **2.1. Task 1: Care and maintenance of corals in the onshore nursery**

One senior and three staff aquarists are responsible for the care and maintenance of existing and new rescue corals, overseen by the project PI. This task includes maintenance of water quality via weekly water changes in the NSU Building Nursery and SEACOR coral rescue holding systems, daily equipment checks and repairs as necessary to ensure that all systems are operating normally. Regular health inspections are conducted on all colonies in holding. Corals receive regular health inspections on all colonies in holding, are fed three times weekly, and pests, epiphytes, and algae are removed from coral colonies. Any damaged, bleached, or diseased corals are maintained in a separate system(s) for quarantine care and treatment. A daily log of coral care and maintenance activities is maintained. This task also includes acclimation of incoming corals to nursery conditions, as well as preparation and packaging of corals for transport between intermediate facilities and long-term holders. Quarterly updates of the number of corals maintained in the NSU Building Nursery and the SEACOR systems have been provided to DEP.

Corals of several species which have been affected by STCLD have been fragmented or microfragmented; this includes corals collected for research purposes in previous years and corals of opportunity which have been collected and brought to NSU. Coral fragments and microfragments are maintained in the NSU Building nursery. Temperature is maintained with a heat exchanger and process chilled water. Filtration consists of a protein skimmer with ozonation, a UV sterilizer, and a media/carbon reactor. A calcium reactor is used to maintain calcium levels and facilitate coral growth. In-tank circulation is provided by submersible powerheads and wave timers. Coral fragments and microfragments are also maintained in two indoor propagation systems (each with two 200-gallon raceways and independent life support systems). For the indoor systems, temperature is maintained with in-line chillers and submersible heaters. Filtration consists of protein skimmers and media/carbon reactors. Calcium reactors are used to maintain calcium levels and facilitate coral growth. In-tank circulation is provided by submersible powerheads and wave timers, and lighting is provided by Ecotech Radion XR30 Pro LED lights. Corals are visually assessed for general health condition daily and fed three times weekly ad libitum to promote growth and enhance survival rates. Water quality is maintained via weekly water changes, with daily equipment checks and maintenance as necessary to ensure that the system is operating normally.

Corals of opportunity have been fragmented and monitored monthly for growth. Twenty different genotypes of *Siderastrea siderea* (SSID) have been growing under

close monitoring in the onshore nursery. To measure size and growth of the fragments, scale referenced photographs were processed using Image J's polygon selection and measurement features, using the metric ruler in each image for scale. The change in amount of living tissue on each fragment is tracked and shown as the average cm<sup>2</sup> for each colony's fragments, the parent colony's surface area is also shown if the whole colony was not used to make fragments.

### 3. Results

#### 3.1. Task 1: Care and maintenance of corals in the onshore nursery

NSU currently no longer holds any naive rescue corals, as they have all been transported to Association of Zoos & Aquariums (AZA) facilities or other approved holders, NSU currently holds a diverse inventory of corals native to south Florida. NSU's onshore nursery operations continue to facilitate not only our goals but also other labs such as Dr. Gilliam (NSU), Dr. Walker (NSU), and Dr. Figueiredo (NSU), and we continue to provide a biosecure space for the care of new colonies brought in as corals of opportunity, diseased/agitated colonies, as well as growing fragments, and providing a secure, reliable and flexible space for emergency storage of corals from other facilities. The NSU onshore nursery remains as a pillar of support for other NSU labs, utilizing our unique workspace to facilitate the recycling of water for fish research in the fisheries lab, and for fine-tuning E-DNA primers by sampling our water for trace DNA for endangered coral species. The onshore nursery currently holds 3,993 corals in total; 468 colonies and 3,525 fragments, representing 19 stony coral species. Additionally, we provide essential support to government agencies such as the Army Core of Engineers, Florida Fish & Wildlife (FWC), and National Oceanic and Atmospheric Administration (NOAA), taking in corals from environmental contractors when corals moved for mitigation cannot be immediately transplanted. A summary of the current coral inventory is provided in Table 1, and detailed inventory of colonies and fragments in the Onshore Nursery is provided in Figure 1. An inventory of corals moving through the NSU Onshore Nursery, either for outplanting or for shipment to other facilities between July 2025 and June 2026, are shown in Table 2 and Table 3.

**Table 1: Coral inventory in the NSU On-Shore Coral Nursery**

|                              | Colonies | Fragments | Total |
|------------------------------|----------|-----------|-------|
| <b>Building Nursery</b>      |          |           |       |
| <i>Acropora cervicornis</i>  | 0        | 5         | 5     |
| <i>Cladocora arbuscula</i>   | 47       | 0         | 0     |
| <i>Coenocyathus sp.</i>      | 13       | 0         | 13    |
| <i>Colpophyllia natans</i>   | 7        | 63        | 70    |
| <i>Montastraea cavernosa</i> | 22       | 226       | 248   |

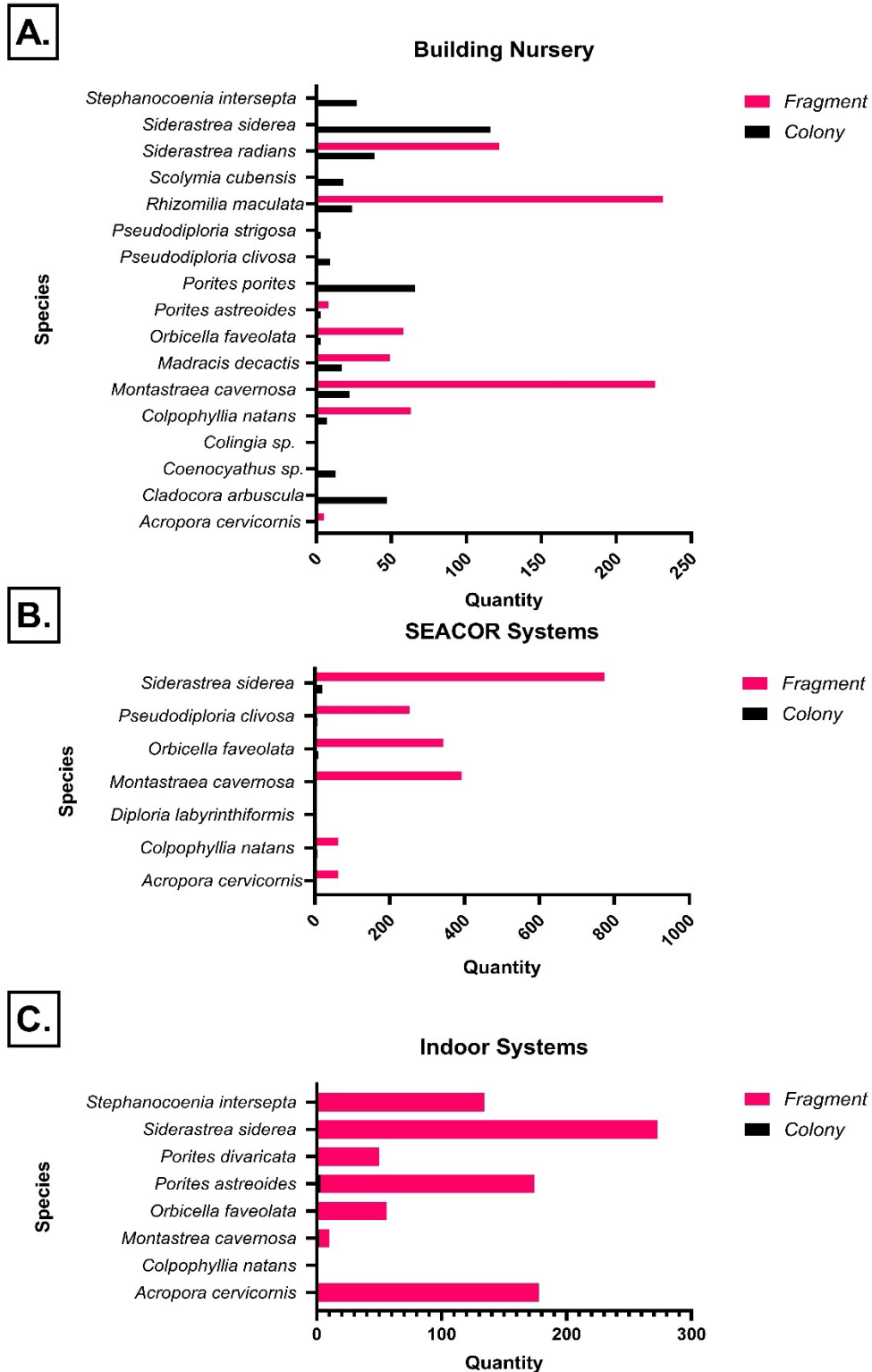
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|                                  |     |       |       |
|----------------------------------|-----|-------|-------|
| <i>Madracis decactis</i>         | 17  | 96    | 113   |
| <i>Orbicella faveolata</i>       | 3   | 9     | 12    |
| <i>Porites astreoides</i>        | 3   | 8     | 11    |
| <i>Porites porites</i>           | 66  | 0     | 66    |
| <i>Pseudodiploria clivosa</i>    | 9   | 0     | 9     |
| <i>Pseudodiploria strigosa</i>   | 3   | 0     | 0     |
| <i>Rhizomilia maculata</i>       | 24  | 231   | 255   |
| <i>Scolymia cubensis</i>         | 18  | 0     | 18    |
| <i>Siderastrea radians</i>       | 39  | 122   | 161   |
| <i>Siderastrea siderea</i>       | 116 | 0     | 116   |
| <i>Stephanocoenia intersepta</i> | 27  | 0     | 27    |
| <b>Total</b>                     | 414 | 762   | 1,176 |
| <b>SEACOR Systems</b>            |     |       |       |
| <i>Acropora cervicornis</i>      | 0   | 63    | 63    |
| <i>Colpophyllia natans</i>       | 7   | 63    | 70    |
| <i>Diploria labyrinthiformis</i> | 4   | 0     | 4     |
| <i>Montastraea cavernosa</i>     | 1   | 392   | 393   |
| <i>Orbicella faveolata</i>       | 9   | 344   | 353   |
| <i>Pseudodiploria clivosa</i>    | 7   | 253   | 260   |
| <i>Siderastrea siderea</i>       | 20  | 773   | 793   |
| <b>Total</b>                     | 48  | 1,888 | 1,936 |
| <b>Indoor Systems</b>            |     |       |       |
| <i>Acropora cervicornis</i>      | 0   | 178   | 178   |
| <i>Colpophyllia natans</i>       | 1   | 0     | 1     |
| <i>Montastraea cavernosa</i>     | 2   | 10    | 12    |
| <i>Orbicella faveolata</i>       | 0   | 56    | 56    |
| <i>Porites astreoides</i>        | 3   | 174   | 177   |
| <i>Porites divaricata</i>        | 0   | 50    | 50    |
| <i>Stephanocoenia intersepta</i> | 0   | 134   | 134   |
| <i>Siderastrea siderea</i>       | 0   | 273   | 273   |
| <b>Total</b>                     | 6   | 875   | 881   |
| <b>Overall Totals</b>            | 468 | 3,525 | 3,993 |

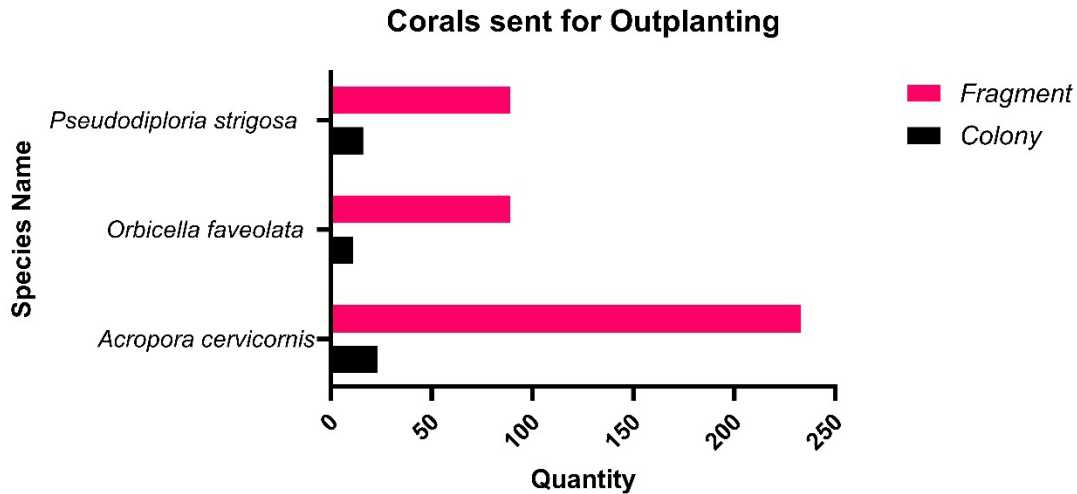
The onshore nursery currently holds a large number of coral fragments from 19 species. Since the completion of the deep cleaning of the building nursery, slime algae and mermaid cups (*Acetabularia calyculus*) have been extremely sparse. Old challenges were replaced by new ones this spring – the cold front that swept across South Florida highlighted some weaknesses in our heating systems that demanded

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immediate repair and improvement (such as the campus's back-up generator failing to turn on). Services and changes have been made to the system to ensure a consistent power supply in the future. Emergency protocols for winterizing tanks beyond our usual needs have also been established to combat unusually cold weather.



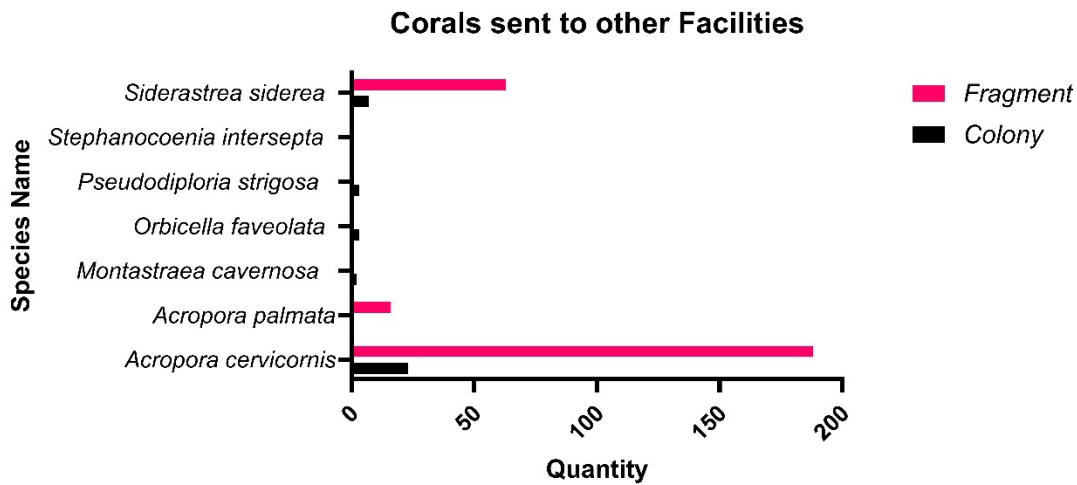
**Figure 1.** A) Species of colonies and fragments currently in the inventory of the Building Nursery, B) species of colonies and fragments in the inventory in the SEACOR systems, C) species of colonies and fragments in the inventory in the Indoor systems. Tabulated data may be seen in table 1.



**Figure 2:** Composition and total of coral colonies and fragments outplanted from the onshore nursery July 2025 – June 2026; Tabulated data in table 2 of this document.

**Table 2:** Inventory of corals outplanted from the Onshore Nursery July 2025 – June 2026.

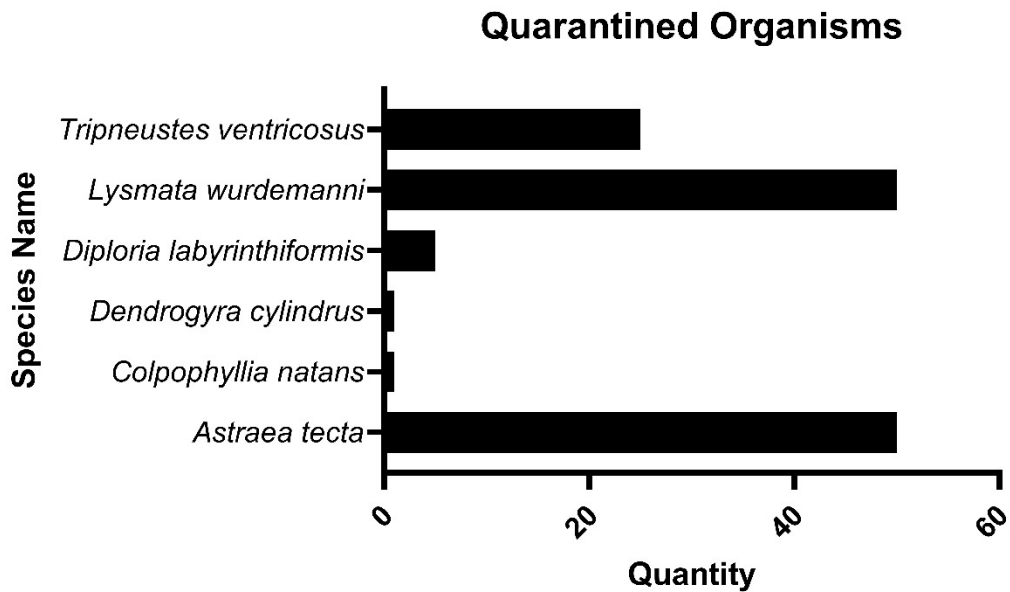
| Outplanted Corals              | Colonies | Fragments | Total |
|--------------------------------|----------|-----------|-------|
| <i>Acropora cervicornis</i>    | 23       | 233       | 256   |
| <i>Orbicella faveolata</i>     | 11       | 89        | 100   |
| <i>Pseudodiploria strigosa</i> | 16       | 89        | 105   |
| <b>Overall totals</b>          | 40       | 411       | 461   |



**Figure 3:** Colonies and fragments of corals shipped to other facilities from the NSU onshore nursery from July 2025 - June 2026; Tabulated data can be found in Table 3 of this document.

**Table 3:** Inventory of coral shipped from the Onshore Nursery July 2025 – June 2026.

| Shipped Corals                   | Colonies  | Fragments  | Total      |
|----------------------------------|-----------|------------|------------|
| <i>Acropora cervicornis</i>      | 23        | 188        | 211        |
| <i>Acropora palmata</i>          | 0         | 16         | 16         |
| <i>Montastraea cavernosa</i>     | 2         | 0          | 2          |
| <i>Orbicella faveolata</i>       | 3         | 0          | 3          |
| <i>Pseudodiploria strigosa</i>   | 3         | 0          | 3          |
| <i>Stephanocoenia intersepta</i> | 1         | 0          | 1          |
| <i>Siderastrea siderea</i>       | 7         | 63         | 70         |
| <b>Overall totals</b>            | <b>39</b> | <b>267</b> | <b>306</b> |



**Figure 4:** Graphical inventory of organisms quarantined for other labs or institutions July 2025 - June 2026 by the NSU onshore nursery. Tabulated data available in table 4 of this document.

**Table 4:** Inventory of organisms quarantined in the Onshore Nursery July 2025 – June 2026.

| Species Name                     | Quantity |
|----------------------------------|----------|
| <i>Astraea tecta</i>             | 50       |
| <i>Colpophyllia natans</i>       | 1        |
| <i>Dendrogyra cylindrus</i>      | 1        |
| <i>Diploria labyrinthiformis</i> | 5        |
| <i>Lysmata wurdemanni</i>        | 50       |
| <i>Tripneustes ventricosus</i>   | 25       |
| <b>Overall total</b>             | 132      |

#### 4. Discussion

The mission of the NSU Onshore Coral nursery is to serve as a multipurpose, *ex-situ* onshore coral nursery dedicated to support the preservation and restoration of the Florida reef tract. The nursery is a hub for coral nursery activities; hosting corals for grow-out/micro-fragmentation, holding corals for out planting, holding endemic corals that are pending shipment to other holders, providing support for nearby coral holders, and

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quarantining maintenance animals. The nursery provides a biosecure space for the care of new colonies, diseased/agitated colonies to be treated, and fragment grow-out of stony corals. This facilitates not only our own specified goals but also other labs such as Dr. Gilliam (NSU), Dr. Walker (NSU), and Dr. Figueiredo (NSU). Additionally, we provide essential support to government agencies such as the US Army Corps of Engineers & Florida Fish & Wildlife (FWC), taking in coral from environmental contractors when corals moved for mitigation cannot be immediately transplanted. Going forward, our focus continues to be the care and maintenance for the endemic corals in our systems and support for ongoing coral transfer activities, including acclimation of incoming corals to nursery conditions, and preparation and packaging of corals, direct transportation from collection to other project partners when needed, and short-term housing for corals that are pending transplantation. We continue to make improvements to our onshore nursery facilities, such as enhancing filtration and system water volume, to improve our overall utility and improve husbandry. By August 2026, 22 new coral aquaculture systems will be become operational – greatly expanding our holding and propagation capabilities.

The nursery husbandry team maintains inter-organization and public communication activities, including interactions with other intermediate holding and AZA facilities, participation in weekly conference calls, and troubleshooting and problem solving through email and telephone conferences with partners. NSU is continuing to utilize the SEACOR system as quarantine space for maintenance animals (Such as sea urchins, shrimps, snails, etc.) that can be distributed to other coral rescue facilities and NSU's internal labs.

The onshore nursery currently holds 3,993 corals in total; 468 colonies and 3,525 fragments. There are 19 stony coral species represented by nearly 4,000 corals. A total of 461 corals held in the nursery have been out planted since July of 2025, and an additional 306 have been shipped to other facilities in the same period.