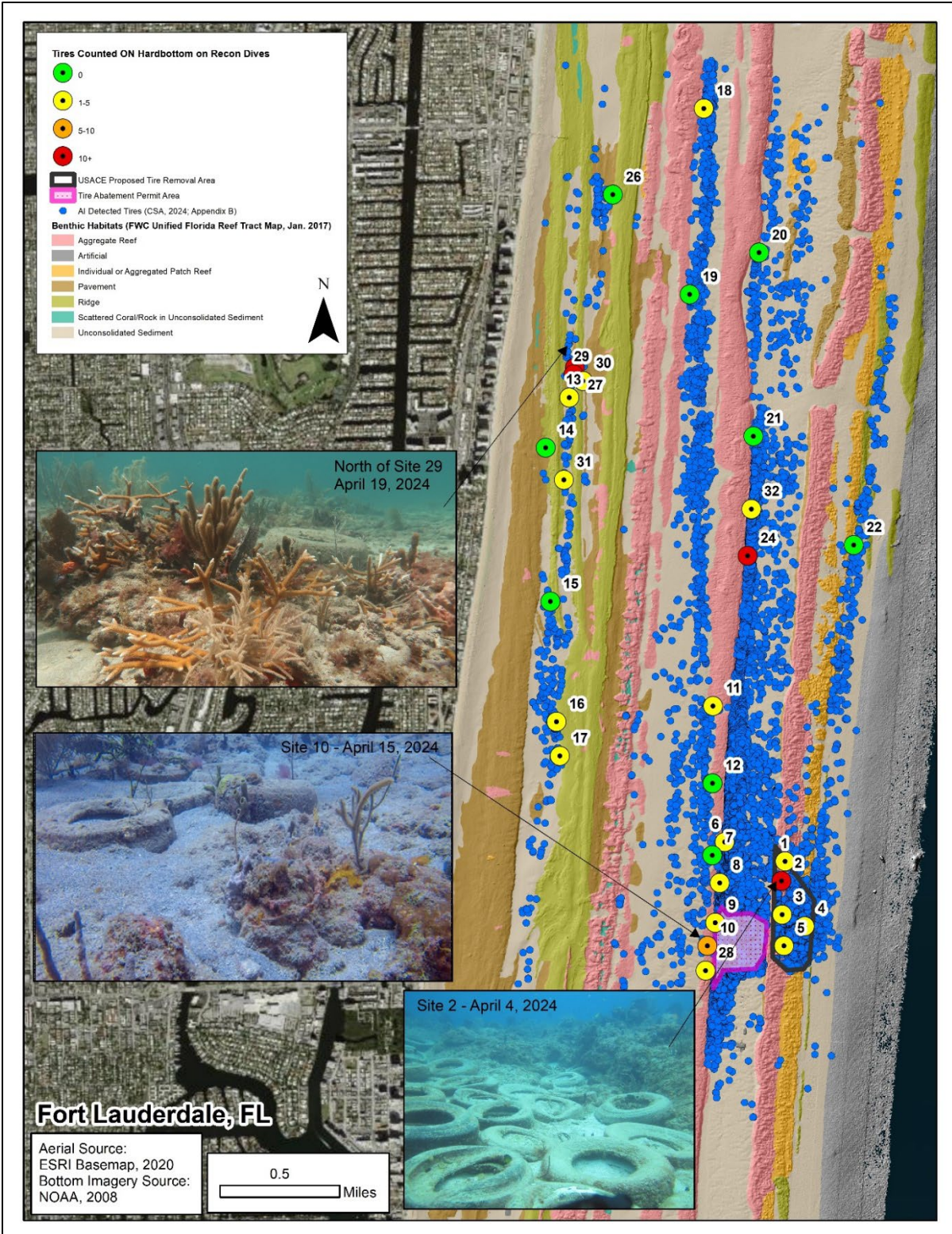


## **Appendix C – 2024 Reconnaissance Survey Methods & Results**

Coastal Eco Group (CEG) was contracted by the Florida Department of Environmental Protection (DEP) to conduct an in-water reconnaissance survey (2024 Recon Survey) to better understand the interaction between tires and coral reef habitat. Divers quantified the number and condition of tires on reef habitat, the severity of tire-related impacts to reef substratum and fauna and the degree to which tires had been recruited to by sessile reef organisms (e.g., macroalgae, sponges, octocorals and stony corals). Recon sites were targeted using the side scan sonar results and detected tire locations from the 2024 Tire Survey, which are displayed in **Figure C-1**. The 2024 Tire Survey report is provided in **Appendix B**. Dive sites were selected from within the extent of densest tires adjacent to coral reef habitat in the data provided. Recon sites were assigned numerical identifiers and priority was given to sites with the greatest potential for reef impacts based on their proximity to dense tire aggregations. CEG divers conducted dives at T30 discrete sites from April 1 to April 15, 2024. Locations and dives completed during the survey are presented in **Figure C-1**.

A scale was developed to rank four criteria to provide comparable data at each site: Tire Condition, Fauna on Tire, Reef Fauna Impact and Substrate Impact on a scale from 1-5 for severity of impacts, with 5 being the greatest (**Table C-1**). However, Tire Condition rankings are based on the amount of tire exposed, from loose (Rank 1) to buried (Rank 5), which is not representative of their potential to cause damage to the benthos. Therefore, Tire Condition #1 represents the greatest probability of movement of the tire, and therefore the most likely to cause immediate damage to reef fauna and substrate. The Fauna on Tire score indicates the estimated percent cover of biotic growth, including stony coral, on tires in the diver's assessment area. Ranks 4 and 5 indicate stony coral growth, with rank 5 representing greater than 30% cover. Ranks 2 and 3 indicate growth other than stony corals and rank 1 indicates no growth. The Reef Fauna Impact score is an estimate of the impact on the surrounding fauna caused by the tires in the assessed area. Bare substrate and damaged organisms indicate that the tires have caused impacts to the reef biota. A rank of 5 indicates that over 80% of the fauna surrounding the tires has been damaged. The Substrate Impact score is similar to the Reef Fauna Impact score but estimates the damage to the substrate surrounding the tires.

Each site was located by the vessel with a Trimble Geo 7x DGPS, and a weighted line and buoy were dropped. If the drop point was found to be outside 10 m from any coral reef habitat, the weight was moved closer to the coral reef edge and an estimate of the distance and direction moved was recorded. Two to four CEG scientific divers were deployed at each site, dividing up the survey area into halves or quarters, depending on the number of divers. The divers performed the survey within a 15 m radius of the weight, collecting severity of impacts data, GoPro 11 HD video and still photos. The number of tires at each site were estimated within 5 ranges: 0, 1-10, 11-25, 26-50 or >50 tires. The location of tires was also fit to three criteria: on coral reef habitat, edge of coral reef habitat (within 1 m of the coral reef habitat edge) and in sand. The general presence or absence of stony corals >5 cm diameter on tires, and any ESA listed stony corals near or on the tires were noted. From field datasheets, in addition to all scores recorded, the highest scores for each of the four 'severity of impact' criteria were entered into a MS Excel spreadsheet as the overall score at each site. Select images from sites with the greatest impact potential are shown in **Image C-1 (a-d)**. A comprehensive photo gallery at the end of this appendix.



**Figure C-1.** Reconnaissance dive locations depicted among the AI detected tire locations on the coral reef habitat offshore of Broward County, Florida with georeferenced example habitat images.

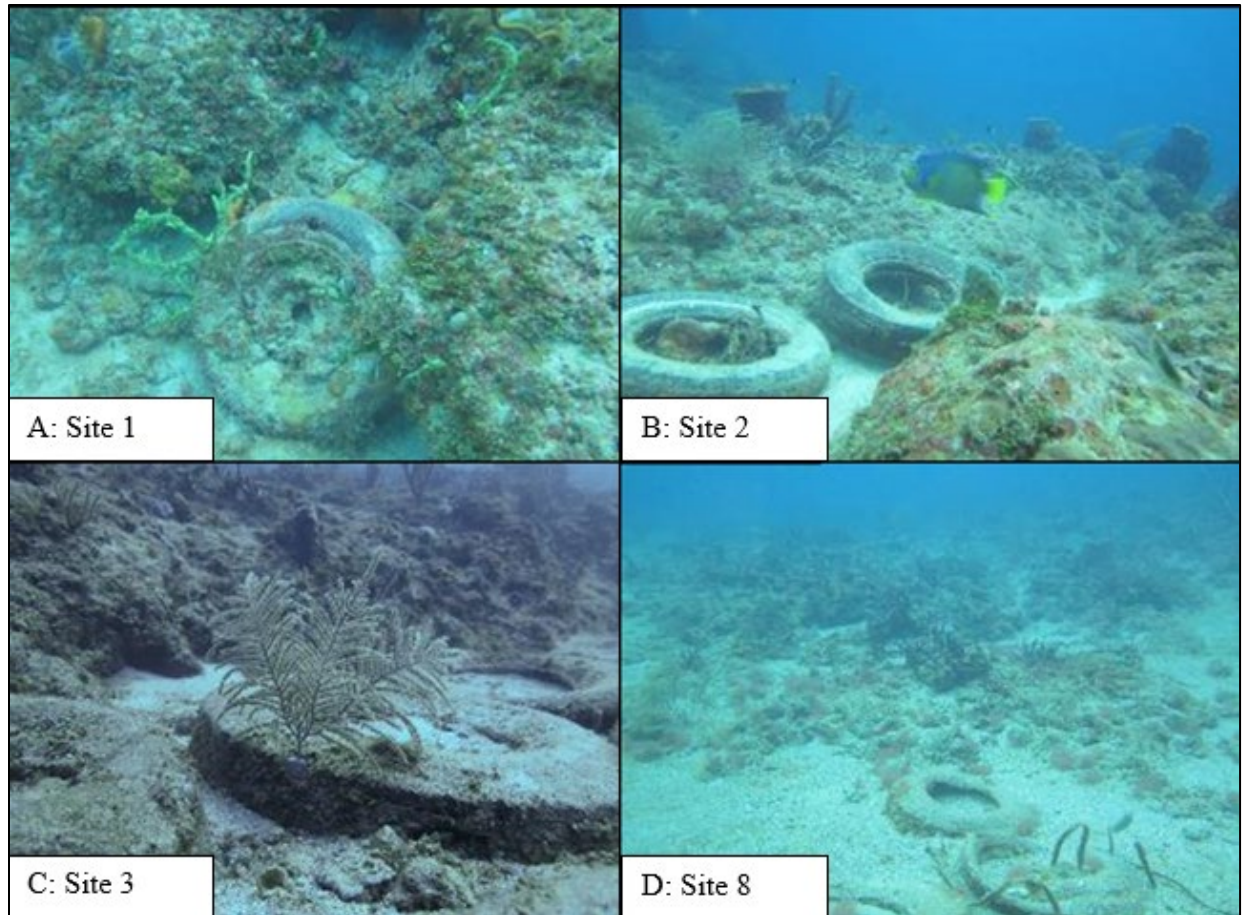
**Table C-1.** Reconnaissance dive impact severity scale used in data collection.

| Tire Condition                       | Fauna on Tire                                   |
|--------------------------------------|---|
| 1- Free, 100% Exposed, likely mobile | 1- No Flora or Fauna                            |
| 2- Loose, mostly exposed             | 2- No Fauna, with Turf/Macroalgae, CCA          |
| 3- Trapped in hardbottom/part buried | 3- >10% other (sponge, hydroid etc.) fauna      |
| 4- >Half buried/entrapped, immobile  | 4- Attached stony corals/ octocorals >10% cover |
| 5- >90% Buried/entrapped, immobile   | 5- Attached stony corals/ octocorals >30% cover |
| Reef Fauna Impact                    | Substrate Impact                                |
| 1- Less than 20% fauna damage        | 1- Less than 20% substrate damage               |
| 2- 20-40% fauna damage               | 2- 20-40% substrate damage                      |
| 3- 40-60% fauna damage               | 3- 40-60% substrate damage                      |
| 4- 60-80% fauna damage               | 4- 60-80% substrate damage                      |
| 5- >80% fauna damage                 | 5- >80% substrate damage                        |

ESA Coral Species: Elkhorn coral (*A. palmata*), Staghorn coral (*A. cervicornis*), Lobed star coral (*O. annularis*), Pillar coral (*D. cylindrus*), Mountainous star coral (*O. faveolata*), Boulder star coral (*O. franksii*) and Rough cactus coral (*M. ferox*).

The data collected on the recon dives are summarized in **Table C-2**. Tires were found on or within 15 m of all recon sites. The greatest number of tires (11-25 tires) on coral reef habitat was recorded at four sites (Sites 2, 24, 27 and 29), which also had the most tires at the edge of any coral reef habitat. Five sites (2, 3, 4, 24 and 32) had >50 tires in sand nearby and Site 2 had the greatest tire density for all three criteria. Tires were not recorded on top of coral reef habitat at nine sites, which also generally had the lowest overall abundance of tires on each. Due to the shape of the reef formations, tires have aggregated in sandy patches between the more rugose fingers of the coral reef at many recon sites, or in the sand abutting high relief coral reef habitat. The largest tire aggregations though the tire distribution survey area were observed at the edge of coral reef habitat and in sand within 15 m of the reef edge. Seven sites were documented with loose tires (**Table C-2**, “1\*”), many on coral reef habitat including Site 2 (**Image C-1b**), which represent areas with the greatest potential for new impacts. These tires would be the easiest to recover quickly, and represent the most critical, potential threat to the ecosystem from movement. Buried, more than half buried and trapped tires (Ranks #5, 4 and 3, respectively) would represent the most perturbation of substrate if removed, and generally had greater numbers of attached fauna including corals, sponges and octocorals.

Attached anthozoan fauna (Fauna on Tire category as Rank #5, **Table C-1**) consisted of octocorals and stony corals (**Image C-1a**) at >30% cover (Rank #5). Four sites had tires with this ranking (**Table C-2**). The reef fauna impact category represented areas where tires have damaged reef fauna. In general, most sites had low scores of 1-2. The greatest recorded impact on reef fauna was represented by Rank #3 indicating 40-60% of damage to fauna (Sites 3, 8, 11 and 27). This damage was typified by areas of reef devoid of fauna in a band along the bottom portion of coral reef habitat from the sand/reef interface to approximately 0.5 m above the seafloor. These areas were only occupied by turf and crustose coralline red algae representing potential damage caused by shifting of tires eliminating attached reef fauna, and/or preventing any new growth. This was similar in the data recorded in the substrate impact category, all of which ranked in the little to no impact categories (Rank #1-2). Only Site 3 had substrate damage recorded between 40-60% (Rank #3), which was coral reef habitat scrubbed bare of flora and fauna.



**Image C-1.** Representative photos of tires on/near coral reef habitat. (A) Sites 1, (B), Site 2, (C) Site 3 and (D) Site 8, from the April 2024 reconnaissance dives, photographed by CEG.

Stony corals >5 cm were found on tires at 18 of the sites, but no ESA listed coral species were found attached to tires. Corals commonly found on tires consisted of *Siderastera siderea* and *S. radians*, *Montastraea cavernosa*, *Porites astreoides* and *Solenastrea bournoni*; however other species were observed. Four sites in shallower waters, between 20 and 40 ft, also contained *A. cervicornis* nearby, not attached to tires but representing corals in potential danger from damage caused by tire movement. Following the dives at many sites, divers drifted over additional deposits of tires, suggesting many more areas of similar tire related impacts exist, compared to the 30 sites investigated during the recon survey in 2024. One *A. cervicornis* colony was found inside and around a tire during a drift north from Site 29, (**Image C-2**) and a DGPS position was taken on the area of the tire. Other ESA corals identified on the reefs near tires were *Orbicella faveolata*, at Sites 9, 21, 24 and 29 and *Mycetophyllia* sp. at Site 32.

**Table C-2.** Recon site data: greatest severity from impact scores, stony coral presence or absence (P/A) and estimated number of tires and their locations within each site. “(1\*)” denotes Sites with loose tires, (Rank #1 per **Table 1**); “A\*” denotes Sites with *Acropora cervicornis* present but not attached to tires.

| Site | Depth (ft.) | Tire Condition Score | Fauna on Tire Score | Reef Fauna Impact Score | Substrate Impact Score | Stony Corals $\geq 5\text{cm}$ (P/A) | ESA Listed Corals (P/A) | Tire Location Description |                    |                    |
|------|-------------|----------------------|---------------------|-------------------------|------------------------|--------------------------------------|-------------------------|---------------------------|--------------------|--------------------|
|      |             |                      |                     |                         |                        |                                      |                         | On Hardbottom             | Edge of Hardbottom | In sand within 50' |
| 1    | 68          | 4                    | 4                   | 2                       | 2                      | P                                    | A                       | 1-10                      | 11-25              | 11-25              |
| 2    | 62          | 3 (1*)               | 4                   | 2                       | 2                      | P                                    | A                       | 11-25                     | 26-50              | 50+                |
| 3    | 66          | 3 (1*)               | 5                   | 3                       | 3                      | P                                    | A                       | 1-10                      | 26-50              | 50+                |
| 4    | 98          | 4 (1*)               | 5                   | 2                       | 2                      | P                                    | A                       | 1-10                      | 26-50              | 50+                |
| 5    | 75          | 4 (1*)               | 4                   | 1                       | 1                      | P                                    | A                       | 1-10                      | 11-25              | 26-50              |
| 6    | 63          | 3                    | 3                   | 1                       | 1                      | A                                    | A                       | 1-10                      | 1-10               | 1-10               |
| 7    | 55          | 4                    | 4                   | 1                       | 1                      | P                                    | A                       | 0                         | 11-25              | 26-50              |
| 8    | 58          | 5                    | 3                   | 3                       | 2                      | P                                    | A                       | 1-10                      | 1-10               | 1-10               |
| 9    | 62          | 4                    | 2                   | 1                       | 2                      | A                                    | A                       | 1-10                      | 0                  | 1-10               |
| 10   | 55          | 4                    | 3                   | 2                       | 2                      | P                                    | A                       | 1-10                      | 1-10               | 1-10               |
| 11   | 50          | 3                    | 4                   | 3                       | 2                      | P                                    | A                       | 1-10                      | 1-10               | 1-10               |
| 12   | 50          | 4                    | 2                   | 1                       | 1                      | A                                    | A                       | 0                         | 1-10               | 1-10               |
| 13   | 21          | 3                    | 2                   | 1                       | 1                      | A                                    | A                       | 1-10                      | 1-10               | 1-10               |
| 14   | 24          | 3                    | 5                   | 1                       | 1                      | P                                    | A                       | 0                         | 1-10               | 1-10               |
| 15   | 26          | 3 (1*)               | 2                   | 1                       | 1                      | A                                    | A*                      | 0                         | 1-10               | 1-10               |
| 16   | 30          | 4                    | 3                   | 1                       | 1                      | A                                    | A*                      | 1-10                      | 1-10               | 1-10               |
| 17   | 32          | 5                    | 4                   | 2                       | 2                      | P                                    | A*                      | 1-10                      | 1-10               | 1-10               |
| 18   | 50          | 3                    | 4                   | 1                       | 1                      | A                                    | A                       | 1-10                      | 1-10               | 11-25              |
| 19   | 41          | 3 (1*)               | 2                   | 1                       | 1                      | P                                    | A                       | 0                         | 0                  | 1-10               |
| 20   | 70          | 3                    | 3                   | 1                       | 1                      | A                                    | A                       | 0                         | 1-10               | 0                  |
| 21   | 72          | 4                    | 4                   | 1                       | 1                      | A                                    | A                       | 0                         | 0                  | 1-10               |
| 22   | 99          | 4                    | 4                   | 1                       | 1                      | P                                    | A                       | 0                         | 1-10               | 1-10               |
| 24   | 70          | 4                    | 5                   | 2                       | 2                      | P                                    | A                       | 11-25                     | 1-10               | 50+                |
| 26   | 22          | 3                    | 2                   | 1                       | 1                      | A                                    | A*                      | 0                         | 1-10               | 0                  |
| 27   | 21          | 3 (1*)               | 2                   | 3                       | 2                      | P                                    | A                       | 11-25                     | 1-10               | 1-10               |
| 28   | 55          | 5                    | 3                   | 2                       | 2                      | P                                    | A                       | 1-10                      | 1-10               | 1-10               |
| 29   | 20          | 3                    | 3                   | 2                       | 2                      | P                                    | A                       | 11-25                     | 26-50              | 1-10               |
| 30   | 20          | 3                    | 3                   | 2                       | 1                      | A                                    | A*                      | 1-10                      | 1-10               | 11-25              |
| 31   | 20          | 4                    | 3                   | 1                       | 1                      | A                                    | A                       | 1-10                      | 11-25              | 1-10               |
| 32   | 72          | 4                    | 5                   | 2                       | 2                      | P                                    | A                       | 1-10                      | 11-25              | 50+                |



**Image C-2.** North of Site 29, one colony and fragments of *A. cervicornis* were found within and nearby a tire. DGPS position of the area was recorded for future reference. Image taken by CEG divers on April 19, 2024.

In situ data collection identified octocorals and sponges as the most abundant fauna attached to tires. Strapping, which originally held stacks of tires together, represents another negative impact that should be considered for removal. Strapping was noted on several sites; including bundles of tire straps left for future removal at Site 8. Additionally, several other sites (depths of ~17 m) where tires are actively being removed had many visible straps protruding from the sand with potential for negative coral reef habitat impacts. One deeper site 24 (~21 m.), also had strapping visible possibly due to tire stacks breaking apart. The tire strapping observed represents another negative impact that should be considered for removal.

Sites on the Middle and Outer Reef in deeper water (20-30 meters) had greater fauna impacts from tires than the shallower sites. Severity of impact followed the density of tires with greater impacts to coral reef habitat in the densest aggregations of tires near the initial tire reef boundary. Loose, mostly exposed tire (tire condition rank=2) with >10% attached stonies/octocorals (fauna on tire rank=4) at Site 1. Image taken by CEG April 4, 2024.

## Photo Gallery





**Photo Gallery Image 1.** A loose, mostly exposed tire (tire condition rank=2) with >10% attached stonies/octocorals (fauna on tire rank=4) at Site 1. Image taken by CEG April 4, 2024.



**Photo Gallery Image 2.** An abundance of tires partially buried (tire condition rank=3) with over 10 tires observed on hardbottom at Site 2. Image taken by CEG April 4, 2024.



**Photo Gallery Image 3.** A tire trapped in hardbottom (tire condition rank=3) with >30% observed stonies/octocorals and other fauna present (fauna on tire rank=5) and 20-40% fauna damage (reef fauna impact rank=2) observed at Site 4. Image taken by CEG April 4, 2024.



**Photo Gallery Image 4.** A tire trapped in hardbottom and partially buried (tire condition rank=3) with >10% stonies/octocorals present (fauna on tire rank=3) observed at Site 6. Image taken by CEG April 1, 2024.



**Photo Gallery Image 5.** Multiple tires with >10% fauna (fauna on tire rank=3) observed at Site 10. Image taken by CEG April 15, 2024.



**Photo Gallery Image 6.** Loose, mostly exposed tires (tire condition rank=2) with turf and macroalgal growth (fauna on tire rank=2) and 20-40% fauna damage (reef fauna impact rank=2) evident from bent octocorals at Site 13. Image taken by CEG April 4, 2024.



**Photo Gallery Image 7.** A tire with turf, no fauna growth, (fauna on tire rank=2) and 20-40% fauna damage (reef fauna impact rank=2) observed at Site 27. Image taken by CEG April 15, 2024.



**Photo Gallery Image 8.** A tire >80% buried (tire condition rank=5) observed at Site 28. Image taken by CEG April 19, 2024.



**Photo Gallery Image 9.** The edge of a mobile tire and hardbottom ledge with 20-40% substrate damage (substrate impact rank=2), possibly from shifting or rubbing of tire against the reef, observed at Site 29. Image taken by CEG April 19, 2024.



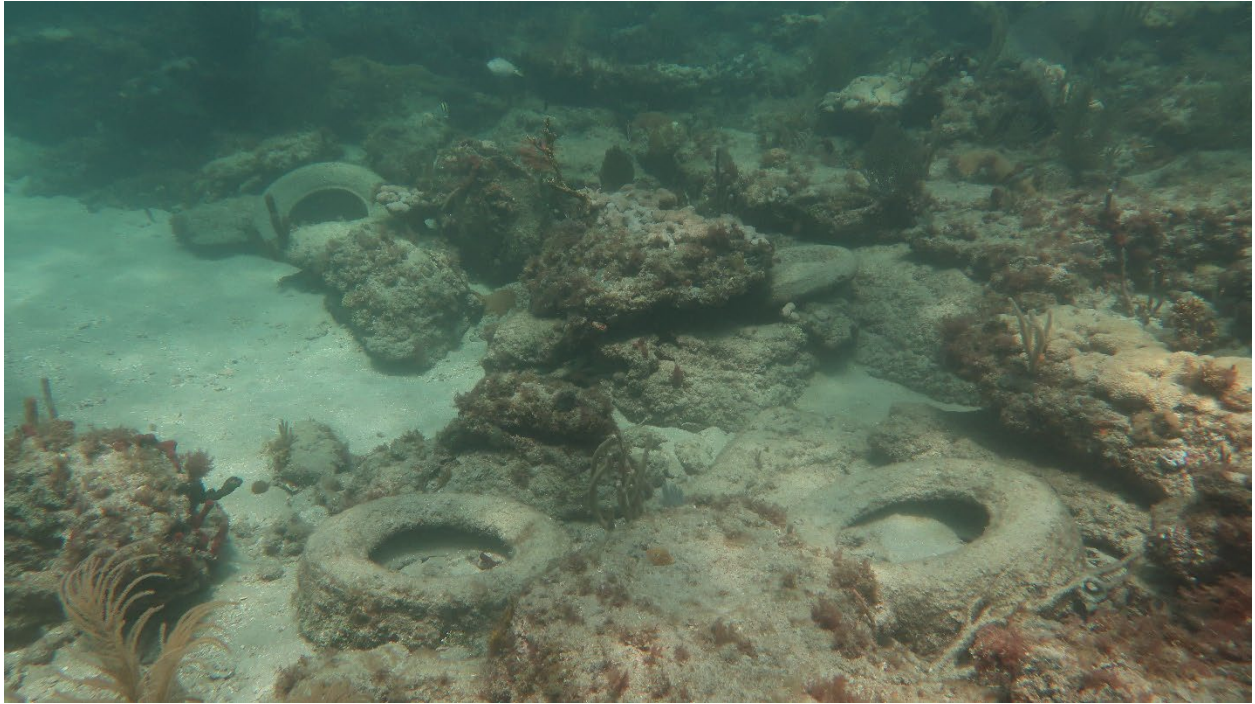
**Photo Gallery Image 10.** A loose, mostly exposed tire (tire condition rank=2) with turf but no fauna growth (fauna on tire rank=2) and less than 20% substrate damage (substrate impact rank=1) observed at Site 30. Image taken by CEG April 19, 2024.



**Photo Gallery Image 11.** A tire near the hardbottom edge with >10% fauna growth (fauna on tire rank=3) and with less than 20% fauna and substrate damage (reef fauna impact and substrate impact ranks=1) observed at Site 31. Image taken by CEG April 19, 2024.



**Photo Gallery Image 12.** A tire >50% buried, entrapped, and immobile (tire condition rank=4) with >30% attached stonies/octocorals (fauna on tire rank=5) and 20-40% fauna and substrate damage (reef fauna and substrate impact ranks=2) observed at Site 32. Image taken by CEG April 19, 2024.



**Photo Gallery Image 13.** Overall image of Site 29 showing density of tires on the reef with potential negative fauna and substrate impact. Image taken by CEG April 19, 2024.



**Photo Gallery Image 14.** ESA-listed *Acropora cervicornis* colonies in close proximity to a loose and moveable tire at Site 29. Image taken by CEG April 19, 2024.



**Photo Gallery Image 15.** Overall image of Site 32 showing density of tires on hardbottom in close proximity to the reef edge with potential negative fauna and substrate impact. Image taken by CEG April 19, 2024.



**Photo Gallery Image 16.** Overall image of Site 24 showing density of tires in close proximity to reef edge with potential negative fauna and substrate impact. Image taken by CEG April 15, 2024.





**Photo Gallery Image 17.** Overall image of Site 32 showing an ESA coral, *Mycetophyllia* sp. (bottom of image), in close proximity to high density of tires against the reef edge with potential negative fauna and substrate impact. Image taken by CEG April 19, 2024.