

2024 U.S. Caribbean Pulse Coral Workshop Notes La Parguera, Puerto Rico

Zoom Meeting Information:

Link: <https://ufl.zoom.us/j/93481596205?pwd=X5vSBb33LrrwCBBIXDsdH4W1aWsJXZ.1>

Phone Number: 305-224-1968

Meeting ID: 934 8159 6205

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Objectives:

- Increase coordination/communication on invasive pulse corals among U.S. coral jurisdictions
- Share information on response efforts, including surveillance, monitoring, removal, permitting, and funding.
- Share information on communication strategies and resources.
- Provide feedback on USVI standard operating procedures for removal.
- Provide context for site visit.

For any questions, contact:

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Agenda- Wednesday, August 7, 2024

Welcome, introductions, icebreaker, review goals and objectives- *Elise Keister & Darimar Dávila Ortiz* (30 minutes)

- Objective - to bring USVI folks to PR to open communication and learn about identification, protocols, and response

Introduction to invasive pulse corals- *Courtney Tierney* (15 minutes)

- What is a pulse coral?
 - Kept in aquariums, beautiful
 - Native to Indo-Pacific and Red Sea
 - 8 Long pulsing tentacles
 - Grow on a stalk
 - Grow quickly with stolen root systems - shoots are vertical, roots horizontal
- Some species already in the Caribbean
- *Unomia stolonifera* and *Xenia umbellata* (5-50m depth) is focus for today
- Pulse corals can outcompete other species even in their native habitats after disturbance = invasive
 - Easily fragmented
 - Asexual and sexual repro
 - Flow with current, and possible human assisted transport
 - Found on many substrates: hard bottom, seagrass, mangrove roots, rock intertidal

- No natural predators
- Can be easily ordered online (!!)
- Have been IDed in Hawaii, Venezuela, Cuba, Puerto Rico

Invasive Pulse Corals in Puerto Rico

Overview- timeline of invasion, current spread- *Dr. Maria Vega Rodriguez (5 minutes)*

- First reports of Xenidiidae in October 2023 - unofficial (facebook comment, unknown coordinates)
- Officially confirmed in February 2024 in Lajas-Gunaica
- Recently confirmed in Caja de Muertos, Ponce, PR
 - Patches of 5-170m²
- Initial removal strategies
 - Manual removal with chisel, breaking attachment rock and bring it up to the surface
 - More removal details provided later
- Awareness campaign
 - Asking for reports from the public
 - Flyer
 - Basic info on pulse corals
 - What to do if you find it
 - Laminated and given to dive shops
 - Updated citizen science trainings to include pulse corals
 - Caja de Muertos report came from citizen science effort
 - Virtual trainings and field trainings
 - News press, social media
- Administrative order March 2024- declared species as invasive, provides a framework for response
- Emergency permit June 2024 - identified partners for training and removal efforts
- Funding - NFWF Emergency funds
 - In order to receive NOAA funding, need an environmental compliance assessment, working on this currently
- Workshops
- Continuous removal

Questions

- What is the compliance assessment process like?
 - Emergency funding is available for assessment (more easily accessible)
 - Removal funding requires a compliance assessment.
 - Proposal includes information about how removal would affect other protected species in the environment.
 - Initial step - ~7 questions about the environment. Process was relatively quick.
- Initial reports - did they come from recreation divers or academic community?
 - Dive company had initial report, but they asked for money for the coordinates
 - A second diver shared coordinates and videos
- Who are the volunteers who help with removal?
 - Academic partners, dive industry, NGOs - a combination of stakeholders
 - Now that there is funding, volunteers can be hired to help with removal

DNER Strategic response plan for the removal of the invasive octocoral (what we know, evaluating distribution, removal efforts, essays with new removal methods, addressing protected species)- Dr. Nilda Jimenez (20 minutes)

- Dynamic strategic response plan - updated as new information is obtained
 - Four sections: background, assumptions, goals, actions
- Helped to have all of the info together and in one place, since it is a dynamic process
- Background
 - Lessons learned from other jurisdictions (Venezuela)
 - Potential invasion routes
 - Venezuela
 - *Unomia stolonifera* was intentionally introduced in Venezuela between 2000-2005
 - Fast propagation, sexual and asexual repro
 - Dramatic change in ecosystems
 - Waiting long to respond had negative impacts (responses not until 2021)
 - Cuba
 - Discovered in September 2022
 - Found in Northern Cuba
 - In smaller patches than found in PR
 - Managing patches by covering, placing tourine underneath and then placing rocks on them
 - Individual removal not helping - as have active recruitment
 - Covering and tourine seems to be working
- Assumptions
 - Feeds heterotrophically and through photosynthesis (zooxan)
 - Comes from the red sea
 - Xeniid family - colony of polyps united by coenenchyme (gelatinous matrix and sclerite)
 - Polyps move in a rhythmic manner (pulsing corals)
 - 20 genus and 162 species
 - *Xenia umbellata*
 - Polyp, stem, pinnated tentacles
 - Polyps can reattach in 2-3 days
 - Really working against time
 - After 10 days budding begins
 - Oral disc, if amputated, can regenerate in 10 days
 - Tentacles can develop into polyps in 21 days
 - Totipotential polyp
 - Need to monitor the site after removal to ensure more recruitment/growth is not occurring
 - Loose fragments can float and adhere
 - If colony is partially removed it will regenerate
 - Covering colonies with dark tarp causes death in 7 days
 - Movement of dark tarp gives mixed results, if you leave it too long, it will just start growing over the tarp
- Goals
 - Identify the distribution of the invasive octocoral in PR

- Control the expansion or removal in PR
- Actions
 - Need to know the locations of the invasions
 - Monitor areas to identify the distribution
 - Transects used to monitor and identify new patches
 - 4.6 km - use a scooter, two divers parallel at 10-25 meters based on vis
 - Divers carry a GPS and collect information when they identify pulse corals (bottom type, depth, size of patch, photos)
 - Removal
 - Remove everything with hammer and chisel
 - Work from edge towards center
 - Place everything in wide-mouth mesh bag, then sealed
 - Removal around rescue corals - remove with tweezers, reattach, monitor (do not move into a nursery! - could spread the invasive)
 - Disposal
 - Everything into a plastic bin on the boat
 - Fill with fresh water once on land
 - Even salt water that had colonies in it is disposed in soil (away from waterways)
 - Calcium hypochlorite, vinegar = doesn't kill
 - Chlorine - kills but can trigger asexual repro, use a bag with weights. This method shouldn't be used if there are endangered species nearby
 - Manual removal with tweezers - lengthy process, need different sizes of tweezers, polyps can be suspended or float away. Can be difficult to remove entire polyp
 - Cement - works with small colonies
- Observing mortality of some pulse corals on the colonies without intervention

Questions

- How long to leave in freshwater?
 - Fairly quickly, leave in freshwater for at least 10 minutes
 - Leave in exposed area to be heated
 - Moved to trash container
- Tarps - Cuba using this method consistently
 - Seeing lots of recruits on the tarps
 - Once polyps are stressed, it triggers asexual reproduction
 - Chloride not included in PR permit
- Should hard corals be removed before tarp is placed?
 - Tarps not used in areas with hard corals
 - Only small areas
 - In areas with other hard corals - attempt to dislodge first, then cement
 - So far, only little colonies of hard corals have been seen in these areas
- It is possible Cuba misidentified the pulse coral
 - Take a sample and send for testing to identify definitively

Shadows over Caribbean reefs: Identification of a new invasive soft coral species, *Xenia umbellata*, in southwest Puerto Rico- *Daniel Toledo (10 minutes)*

- Invasives come in different forms and have different impacts
 - Lionfish, tunicates/sea squirts, *Halophila* (seagrass)
- Knowing your invader is essential

- Outcomes out impacts can be environmental and socio-economical
- Pulse corals
 - Impt to use reliable taxonomical classifications to know your invaders
 - Genetic barcodes to ID
 - Without genetics, can be difficult to ID one species from another
- Caribbean invasive timeline
 - 2007 *Unomia stolonifera* IDed in Venezuela
 - 2017 in Brazil
 - 2023 visually IDed in PR as *Unomia* - but was that really the species?
- Confirm species that is invading PR
 - Sample 3 distinct growth patches in southern PR
 - Multi-gene barcoding (ND2, mtMutS, COI, and 28S)
 - Compare genetic sequences with established xeniid sequences to ID the species present
- Results
 - 100% identical to *Xenia umbellata*
 - For samples from all 3 sites
- Habitat and Depth distribution
 - Observed growing in all habitats, and even on other organisms (e.g. sponges, sea grass)
 - Found even growing in plain sand (very opportunistic)
- Characteristics of *Xenia umbellata*
 - Fast regeneration
 - Outcompete native species for space and resources
 - Found in shallow reef environments
 - Prefers areas with moderate water flow and light availability, not seen in caves
 - Reproduce sexually and asexually
 - Impacts
 - Reduce substrate availability (main concern)
 - Potential to dominate reef habitats, if not controlled
 - Alter reef structure and function
- Ongoing work
 - Produce first draft genome for *Xenia umbellata*
 - Describe associated microbes (e.g. bacteria and Symbiodiniaceae) and viruses associated with *X. umbellata*
 - 93% BUSCOs (Benchmarking Universal Single-Copy Orthologue)
- Future work
 - Control the spread
 - Future research directions: continue monitoring, public awareness, collaborate for effective management
 - Work in progress:
 - Confirm species of 3 colomorphs
 - Compare PR barcode data to other islands
 - Determine route of introductions
 - Is *Unomia stolonifera* here too?
 - Two colomorphs - one has been genetically IDed as *Xenia*, one is being sent out soon for analysis

Questions

- How to differentiate *Xenia* and *Unomia* from *Erythropodium* (encrusting gorgonian)
 - *Xenia* is more feathery

- Unomia spreads on a “mat”, Xenia dettaches polyp
- Pulse corals are ALWAYS pulsing - gorgonians aren't
- Xenia pulses more than Unomia
- Species level ID in the field is not practical - genetic samples are important
- Genetic sample - no preservation solution, put directly into -80 freezer
- Plans to observe/analyze zooxan in different colomorphs?
 - Yes, is ongoing work
- What is the source of pulse corals?
 - Coming from the Red Sea and Indo-Pacific
 - Working on understanding where it came from in PR
 - Aquarium dumping, ballast waters - communicating about both
 - Can become pests in aquariums too - potential for further communication/training here

Permitting- Helena Antuon & Jose Rivera (15 minutes)

(Helena Antuon) -Protected Resources Division

- If federally funded and ESA listed species are involved, must consult with NOAA PRD
 - No way to enforce this
- Protected Resources Division
 - Consultation
 - Informal - not likely to adversely affect
 - Occurs quicker
 - Formal - may affect, likely to adversely affect
 - Section 7 Considerations for pulse coral removal
 - Section 10 permit (non-federal actions)- required for take of threatened and endangered species (turtles, corals)
 - Applications required, will go through initial review, public comment period, then applicant response, final PRD review = this is a long process (about a full year)
 - Habitat conservation evaluation is required for this permit
 - Xenia consultation – southeast PR
 - All actions are covered under programmatic biological opinion except removal of hard bottom and use of tarp
 - If activities are covered under opinion, it's a shorter process (but has to follow exactly what is written)
 - Tiered response - 1) all activities under bio opinion and 2) additional activities not covered
 - Invasive was smothering all features of critical habitat - removal was allowable because it was beneficial for critical habitat
 - Consultation tips
 - Consult on ACTION, not necessarily on area
 - Include language that is flexible for multiple areas (because it could spread, don't want to have to reconsult every time)
 - “Including but not limited to”
 - Always reach out to contacts to plan ahead. Pre-consultation helps immensely!
 - Be conscious of what species you have and are writing in (Unomia vs. Xenia) - use broader language like “the family of pulse corals” - though the consultation is on the activity, not the species or area
 - Include as many details as you can

(Jose Rivera) Habitat Conservation Division

- [Essential fish habitat consultation](#) (under the Magnuson-Stevens Fishery Conservation and Management Act)
 - Essential fish habitat is any habitat that is used by regulated fish to live, eat, and reproduce
 - Any fish covered under the fisheries management plan (e.g.
 - Get this from the Caribbean fisheries management council
 - The consultation is just a communication between those doing the activities and people within the HCD
 - <https://www.fisheries.noaa.gov/national/habitat-conservation/consultations-essential-fish-habitat>
- MUST DO BOTH (consulting with PRD and HCD)

Questions

- Any special considerations with removal from seagrass beds?
 - Will be addressed in Jose's presentation
- Can one agency submit a consultation to cover all territory activities?
 - Contractors need to be written in - but can write "Contractors (TBD)"
 - Also add in any other organizations that may be conducting the action
 - Action agency - any federal or state agency
 - Collaborators need to be included in the consultation, but can be under the action agency's consultation rather than needing their own??
 - If an org is using federal funds, they need a consultation
 - Usually the federal agency is required to take the lead on the consultation

Funding (cost of response, where are funds coming from, additional funds needed, funding strategies)-

Ricardo Lugo (10 minutes)

- USVI prepare to absorb costs upfront and give a value to every action
- Emergency funding (NFWF) - relatively quick
- Shortfalls - didn't account for removal research, equipment availability and maintenance, compensating crews and staff
- Include stakeholders in considerations and when looking for funding

Questions

- PhD student interested in studying reproductive biology of pulse corals -rapid assessment proposal was accepted - is there funding for this student in the program?
 - Maria - Reach out to discuss the funding

Additional Q&A time (30 minutes) (no time for this portion)

Communications

12:45pm Puerto Rico- Sandra Schleier (10 minutes)

- Outreach
 - Flyers handed out to public
 - Talk/Webinar and in person talk for the DR and PR

- In person talk in Cabo Rojo at ISER headquarters during Coral Reef Week
- Continuing talks and webinars, specifically to divers and general public
- News Press
 - Press release
 - Interviews
 - 7 news articles - general descriptions more easily accessible for general public
- Sci-comm
 - Paper in review
- Social Media
 - Flyer shared on social media
 - NGOs are reposting and also creating their own infographics
- TV Interviews
 - Scientists called in for interviews
- Have to point out explicitly that although it's pretty, it's bad for the reef
- Videos are the best way to appeal to public
- Future efforts
 - Flyer will continue to be distributed
 - Webinars with divers
 - More citizen science volunteers - Eyes on the Reef
 - Focus on campaign towards aquarists to not dump

Questions

- Approach popular aquarist youtubers- bring to task force working groups who have been talking to aquarists committees
- Include fishermen

12:55pm U.S. Virgin Islands- Alex Fireman (10 minutes)

- Courtney and Alex and Jordan helped create and distribute laminated flyers
 - Working on giving more out
 - Also put on social media
 - QR code at bottom of flyer to AGRRA site to learn more
 - And a way to report sightings
- Strike Teams (led by Jordan) trained for ID, removal and containment
- Presentations completed
 - VI-CDAC
- Presentations planned
 - St. Croix Fisheries Advisory Council Meeting (scheduled for Sept)
 - CRABBS Dive Club presentation in August
- Discussion: what more should we be doing?
 - If you see it, report it
 - This has been the most successful messaging in PR so far
 - Constant effort to try to reach the stakeholders
 - Schedule meetings and talks to try to reach a majority of the people that are out in the water everyday
 - Particularly diving companies, recreational divers from rural communities, fishers, dive masters

- Schedule dedicated time (even via Zoom) to thoroughly go over ~15 min, to make sure stakeholders fully understand the threat
- Treat outreach as if have the invasive species already there (URGENT)
 - Need to dedicate more time to outreach efforts, not just leftover time

1:05pm Florida- Ana Zangroniz (10 minutes)

- Confirmed Xenia in Cuba - only 90 miles from FL reef tract
 - So Florida is very aware of the threat of this invasive pulse coral
- Florida Coral Reef Resilience Program (FCRRP)
 - Composed of 10 teams to address disturbances
 - Last summer major focus was on the thermal event
 - Have created another team, invasive pulse corals working group, within FCRRP
 - With members from FWC, Miami-Dade County, Florida Sea Grant, etc.
 - Put together a congressional 2-pager for the Spring 2024 USCRTF
 - July press release
 - UF/IFAS in-service training with resources available
 - Part of larger NOAA AIS network
- Willing to share any created products
- Anticipated outreach campaigns (targeted based on audience)
 - Target the divers/snorkelers (for monitoring/reporting)
 - Targeting look but don't touch
 - Aquarists/aquarium industry
 - Two different audiences:
 - Aquarium producers
 - Hobby-ists- with the latter being the larger concern
 - Working on messaging for this
- Post workshop plans
 - Leverage network of UF/IFAS Extension and Florida Sea Grant agents
 - Critical to engage all coastal counties
 - Even where there are not coral reefs, as these pulse corals can grow everywhere
 - Continue collaborations with AGRRA and other partners
 - Share information with DAC
 - Info share via workshop with resource managers and science community
 - Lessons learned
 - Best practices for management/removal
- Take-home message
 - Report and do not remove
 - USGS Nonindigenous Aquatic species reporting
 - Main avenue Florida is trying to use

Questions

- May need to emphasize why this "coral" is bad for lay people who have been told to help corals for a long time
- Have lay divers leave markers on the reef of where they have seen pulse coral
 - Possible debris issue, could move
- Maria mentioned this resource as a way to learn more/stay up to date:
 - <https://www.agrra.org/the-unomia-learning-exchange/>

Additional Q&A (30 minutes)

Courtney- how large of a patch can be removed in one dive

- Very dependent on depth, substrate, density of species
 - Rubble is easiest, just put it all onto a lift bag and no need to chisel
- Nilda- on average 1m² at 80m on nitrox
- Are patches growing?
 - Nilda- focus on satellite patches around main patch first then attack larger one, but its growing while working on others

Maria- aquarium trade removal methods

- "Reef delete" laser ?

2:00 pm – Invasive Pulse Corals in Hawai'i

Overview- timeline of invasion, surveillance & monitoring current spread-*Kevin Lino (15 minutes)*

- Hawaii Working Group
- Timeline
 - 2020 - Benthic validation survey - research divers found a Xenidiidae species in Pearl Harbor
 - 2021 - Navy confirms new genus *Unomia stolonifera*
 - 2022 - Navy commits to eradication 9.14 acres - created mitigation plan
 - 2023 - Multi-agency group formed for response - meet every two weeks, species ID confirmed via genetics, estimated *Unomia* presence in 90 acres and another soft coral species (*Capnella spicata*), Navy hosted Octocoral Workshop
- ROV surveys allowed for density delineation
 - Areas of overlap of two species could likely be introduction/release point
 - Not found in deepest areas (historically dredged)
 - Evaluating growth rates
 - Biogeographic features have helped prevent spread to open ocean
 - Freshwater input upstream of pulse coral presence
 - Limitations on people in the area
 - Low wave energy
- Draft Management Plan was created during workshop
 - Adaptive management approach
 - Survey results: *Unomia* is in 76 acres, *Capnella* is in 0.8 acres (high density), *Rhodactis sp.*, and *Euphyllia sp.* each occupy 0.6 acres
 - Roving diver surveys, photomosaic imagery

Questions

- What is the natural substrate?
 - Limestone bottom
 - Sections of reef with spread out corals
 - Areas with high sedimentation
 - Soft sediment around highly populated areas
 - Consistent dredging - all soft sediment
 - Some seagrass beds interspersed

Removal methods (lessons learned, tips for removal, info on efficacy, monitoring results of removal efforts)- Kevin Lino (30 minutes)

- Unomia - purple to greenish brown
 - Reproduction via stolons, fission, frag, and budding
 - Working on tracking sexual reproduction through sample collection around full moons - likely only spawning gonochorically
 - Xenidiids are restricted without a permit in Hawaii
 - Likely species came to Hawaii illegally (without a permit)
- Mortality research of 4 species (Capnella, Unomia, Anemonia, and Rhodactis)
 - Freshwater treatments and desiccation
 - 5 min freshwater immersion kills all species
 - 24 hour desiccation kills all species
 - Dives in area now use a 5 min freshwater soak
- Popular rec area for fishing - closed fishing to reduce fragmentation and transport
 - Fishing temp prohibited sign has QR code to more info
 - Vessels redirected - some people are unhappy about this
- Public affairs office are putting out regular notices, publishing articles, replying to media inquiries
- Manual removal methods tested
 - Manufactured own bags like fine sand bags and secondary “supersack” that was taken out with a crane then moved to land-based containment area for 24 hour desiccation
 - Saw small (less than 1%) Unomia cover after 10 and 29 days post removal
- Tarp Smothering Trials
 - Impermeable tarps secured with sandbags, prevent sunlight and create anoxic conditions
 - 100% effective in 8 days
 - However, mortality of all benthic fauna
- Pylon Wrap Trial
 - Pallet wrap - difficult installation (material could tear), 7-10 days effective
 - Canvas material - easier installation, opaque - 3-5 days effective, material reusable, secured with Polyken tape
- Upscaling eradication efforts
 - Ramping up large scale smothering efforts
 - Manual removal on west side in lower density areas
 - Tarping and manual removal on the east side with high density
 - Saw recruitment on tarps - those are manually removed
 - Dredging, shading
- Research
 - Histology - Is there sexual repro?
 - Surface supplied heat treatment trial
 - Genetic and AI tools for detection
- Rapid Response Plan
 - USFWS EDRR grant
 - NFWF grant application
 - Coordinating learning exchange
 - Limitations with comms between DoD and Cuba and Venezuela

Questions

- Pushback from closing fishing? How long closed ? threshold ?
 - After full removal, monitor for two years
 - Likely keep closed for that whole time
 - It is difficult to keep people out of the area
 - Conservation law officers in area to enforce
 - Signage posted
 - Open comms
- Manual removal methods?
 - With hands
 - If on rubble, collect whole piece
- Consider adding sediment on top to smother?
 - Working on developing this technique
 - Silt curtains
 - Could be difficult since it's an active military port

**Permitting & Funding (cost of response, funding sources, additional funds needed, funding strategies)-
Kevin Lino (5 minutes)**

- DoD has different restrictions + permitting
- Certain contracting mechanisms - not applicable to other institutions
- NEPA process - biweekly meetings for providing updates
 - Understood some loss now will prevent major loss later
 - Pearl harbor is low coral cover to begin with
- Providing info to senators in state and in DC for funding assistance
- 5-10 years of management but aiming for eradication

Also continued outreach with Marine Aquatic Invasive Species (AIS) in Hawaii - Bishop Museum ?

Additional Q&A time (40 minutes)

- How are you quantifying coral loss?
 - Haven't quantified it
 - Don't know how many corals are there - predicted to be low density areas
 - Habitat equivalency analysis
 - Will be natural recovery, likely no restoration work
 - Urchin hatchery - used to control invasive algae - could help during phase shift post-smothering to keep down algae
- Goal is eradication, but maybe management - What is the tipping point?
 - Some partners have suggested moving to management strategy, some partners think it's an opportunity to eradicate due to it being contained in the harbor
 - "Throwing everything we have at it" - but can't do it indefinitely
 - Threshold may be dynamic, temporal
 - At least 5 years, hoping for full removal in 10
 - NEPA area of 9 acres hope to be done in a year
 - What are the resources we have that are sustainable to keep this effort going for 5 to 10 years
- What is the cost for 5-10 years effort?
 - Can't share, still hiring contractors
 - This is a specific project funded by Congress - installation needs to be funded by a different project

- Millions of dollars per year
- Hard to quantify, lots of in-kind time and such

3:45 pm – U.S. Virgin Islands Standard Operating Procedures for Removal- *Jordan Schneider (30 minutes)*

- Lit review for efficient and cost-effective removal techniques from other coral jurisdictions
- Large vs small scale removal are different
- Tarps - works for mortality, but triggers shedding/fragmentation of polyps
- Knives or hammer and chisel
 - Considering peeling polyps from substrate
 - Strike teams not permitted to remove substrate
- Have small scale SOPs (3ft or less)
- Visual ID
 - Long stalks, pulsing
 - 2 other species that look similar
 - Polyps of Caribbean corals can retract fully into the polyp (unlike other soft corals)
 - Also do not have stalks
- Challenges for Removal
 - Asexual reproduction via fragmentation
- Removal method
 - Aquarium tweezers
 - Try to remove in one piece by peeling it off the substrate
 - As a precaution, treat the removal area with cement (Quikrete)
 - this will smother the entire thing
- Containment Zone
 - Set up net over the removal area to maintain containment
- GPS points, flag and tag exact locations
 - Monitor after 9 days, then two months
- Decontaminate all gear - at least a 5 min freshwater soak
 - If you're boating to different sites, make sure to have "dunk tank" for gear on boat
 - Add freshwater to bags to kill coral, dispose of away from water sources

Questions

- Stay away from mesh bags - smaller stalks could go through (I dont think they would go through spawning nets)
- Nilda says containment area nets are not necessary, just have a containment bag
- Work from edges to center so do not disturb the orgs
- Genotyping immediately upon observation - include this analysis in funding

4:15 pm - Overview of site visit- *Dr. Maria Vega Rodriguez*

- Leave at 6:30am
- Head to Blue Water Scuba
 - Park at [La Guancha](#), X98P+9XP, Calle B, Ponce, 00716, Puerto Rico
- Boat LEAVES at 7:30am

Additional Resources

[AGRRR Learning Exchange](#): A web page created by AGRRR with species descriptions, video recording and slide deck of pulse coral webinar, and an interactive map to track Atlantic/Caribbean pulse coral sightings. You can also contribute to the map by [submitting a report](#) noting the location of observed pulse coral species with the option to upload photos.