Intro1

* As we are all well aware, coral reefs globally are in decline, FCR is no different
* Some of the major contributors: disease, heat stress(bleaching), competition for space, predation

Intro2

* Restoration has been established as a way to mitigate the damage and loss to the reefs -> helps restore biodiversity on multiple ecological levels

Monitoring

* The next critical step post-restoration is monitoring those restored corals
* Need to be able to quantify “restoration”
* Necessary for improving methods
* Traditionally, in water colony monitoring (health of colonies)
* Photogrammetry has become a useful tool to add to monitoring efforts
  + Sfm photogrammetry can assess, in addition, percent cover as well as growth of outplants through time

This project

* Ongoing, long-term restoration study
* As of now this project consists of 40 unique reef ledges on EDR (this number continues to grow over time), where either Apal or Acer has been put back onto the reef
* Mission iconic reefs, goal to restore 7 iconic reef sites to self-sustaining levels
* These ledges are imaged at baseline, and then annually going forwards
  + As of now we are entering the second year of this project, I will be presenting the first year preliminary data
* Main goals of this project
  + Quantify composition changes in the benthic community, post-restoration through time
  + Measure and track percent cover and growth of outplants through time

Image Acquisition

* Once we get to the site, we prep by laying out scale bars (which double as depth markers) throughout.
* Where natural barriers don’t exist (such as spurs or reef ledges) floats are placed to mark boundaries
  + Assists in navigation
* For this project, the cameras used are two gopro 10s set 60 cm on a pvc rig
* For the images themselves, 80% overlap between photos is ideal
  + Conditions can make this harder to achieve at times
* 1 photo per second
* Swimming at a slow enough pace, with the passes close enough to get around the right overlap
* Swim pattern can be described as a modified lawnmower, with short passes having ideal overlap, with a few passes in the perpendicular direction
  + Helps make sure there is no reprojection error (warping or inaccurate 3D generation)

SfM photogrammetry

* Once the imagery has been taken in the manner described, we use agisoft metashape (which is a software able to process 2D images to generate 3D spatial information)
* First generated is the sparse cloud made of points extracted from the alignment of photos
* The dense cloud can then created from the rectification of sparse-cloud points
* This product can then be exported for further annotation

Data collection (Viscore)

* The first steps in the analysis of our models takes place in Viscore, a point-based analytics software, that allows for the interaction with 3D data
* Models are scaled and oriented with what was collected in the field
* Then visual point intercept (vpi) surveys are done, essentially a working area within a model can be set, and with the desired point density set, the program will randomly generate points throughout.
  + we use a density of 25 points per m2
* something really helpful, the points generated, as well as any point placed on the model, is linked to the raw imagery
* makes identification much easier and can account for gaps in the model

Graphs(vpi)

* on the left, acer
* on the right, apal
* on the y axis is relative abundance by percent, x axis is the baseline and 1 year timepoints for comparison
* as you can see, no major changes within the first year post-outplanting, as expecied
* however you can begin to see the signatures of A. pop up into the bar plots
* since this is a long term study, we are excited/expecting to see a gradual trend of the benthic community shift through time as the outplanted coral become more prevalent

Data collection (TagLab)

* The other main software were using for analysis in this project is TagLab, an AI-powered software capable of supporting orthographic images and their analysis
* Models are turned back into 2D products (orthoprojections) before being imported for segmentation (tracing)
* Both semi-automatic and manual tools can be used to outline the target species (in our case just corals outplanted)
* Gives us surface area by category as well as growth of individual colonies over time with the capability of linking colonies from two different orthos
* Taglab also has machine learning capabilities -> ability to teach it to automatically recognize, trace, and classify different benthic species
  + However, there are characteristics and densities hat make some sites more ideal than others for the training and success of this tool