

Standard Operating Procedure (SOP) #16

Benthic Image Analysis

Version 3.02 (July 22, 2022)

Change History

New Version #	Revision Date	Author	Changes Made	Reasons for Change	Previous Version #
2.0	6/30/2007	Eric Brown	See Track Changes	Response to reviewer's comments	1.0
2.01	7/20/2007	Larry Basch	See Track Changes	Corrections, additions	2.0
3.0	8/22/2019	Kelly Kozar	Substantial updates to the PhotoGrid® software instructions, benthic image analysis, and data certification process. Updated SOP #s	To accurately reflect the PhotoGrid® software instructions and benthic image analysis steps. Added a geospatial SOP and had to renumber subsequent SOPs.	2.01
3.01	8/9/2021	Kelly Kozar	Minor updates to content.	Added reference links, minor text edits to make consistent throughout.	3.0
3.02	7/22/2022	Kim Weisenborn	Updated content to refer to new PACN I&M SharePoint. Updated figures to reflect change.	PACN data is no longer stored on a networked server (I:\ drive) and is now stored on the PACN I&M SharePoint site.	3.01

Only changes in this specific SOP will be logged here. Version numbers increase incrementally by hundredths (e.g., version 1.01, version 1.02) for minor changes. Major revisions should be designated with the next whole number (e.g., version 2.0, 3.0, 4.0). Record the previous version number, date of revision, author of the revision, changes made, and reason for the change along with the new version number.

Purpose

This SOP documents the benthic image analysis protocol. The sections of this protocol are presented in order of execution: 1) Selecting the images for analysis, 2) PhotoGrid® analysis, 3) Identification standards, and 4) Exporting data from PhotoGrid®. Additionally, [Appendix SOP 16.a](#) shows various examples of substrate types from digital still images taken in different parks. The use of products identified in this protocol does not imply endorsement, effectiveness, or warranty by NPS.

A master equipment list for the entire Benthic Marine Community Monitoring Protocol can be found in Appendix SOP 1.a of [SOP #1 Before the Field Season](#). The master equipment list should be updated simultaneously if any SOP requiring an equipment list is revised.

Benthic Image Analysis

Downloading Images from the Camera

Data will be downloaded from the camera as soon as possible following the dive. See [SOP #15 Managing Photographic Images](#) for instructions on downloading and storing photographs.

Installing the PhotoGrid Software

If the latest version of the PhotoGrid® software needs to be installed on the user's PC, contact the PACN Data Manager (Kelly Kozar, kelly_kozar@nps.gov) for assistance.

1. Navigate to the “[PhotoGrid1b](#)” data management software folder located in the Pacific Island Inventory and Monitoring Network (PACN I&M) SharePoint site¹ (Figure SOP 16.1).

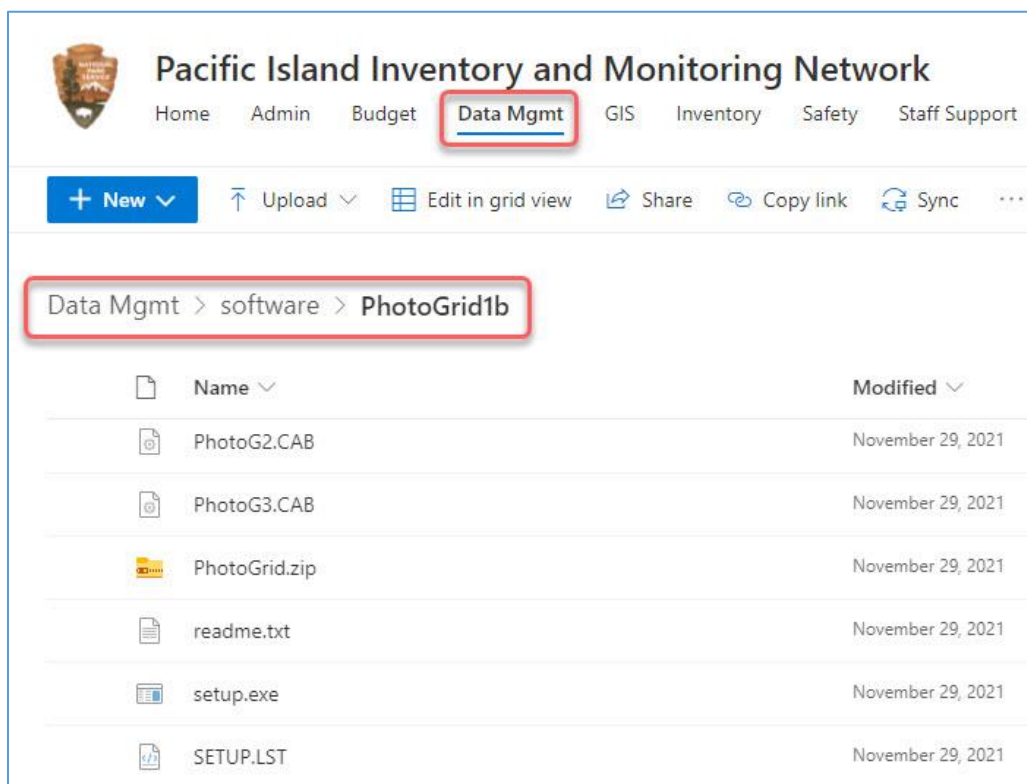


Figure SOP 16.1. Location of latest PhotoGrid® software in SharePoint.

2. Select the “**PhotoGrid.zip**” file to download. There are two options for downloading the file (Figure SOP 16.2):
 - a. Choose the “**Download**” button in the library’s navigation bar.
 - b. Click the vertical ellipse  next to the filename and select “**Download**”.

¹ PACN I&M SharePoint site, <https://doimspp.sharepoint.com/sites/nps-PWR-PACNIM> (accessed 22 July 2022).

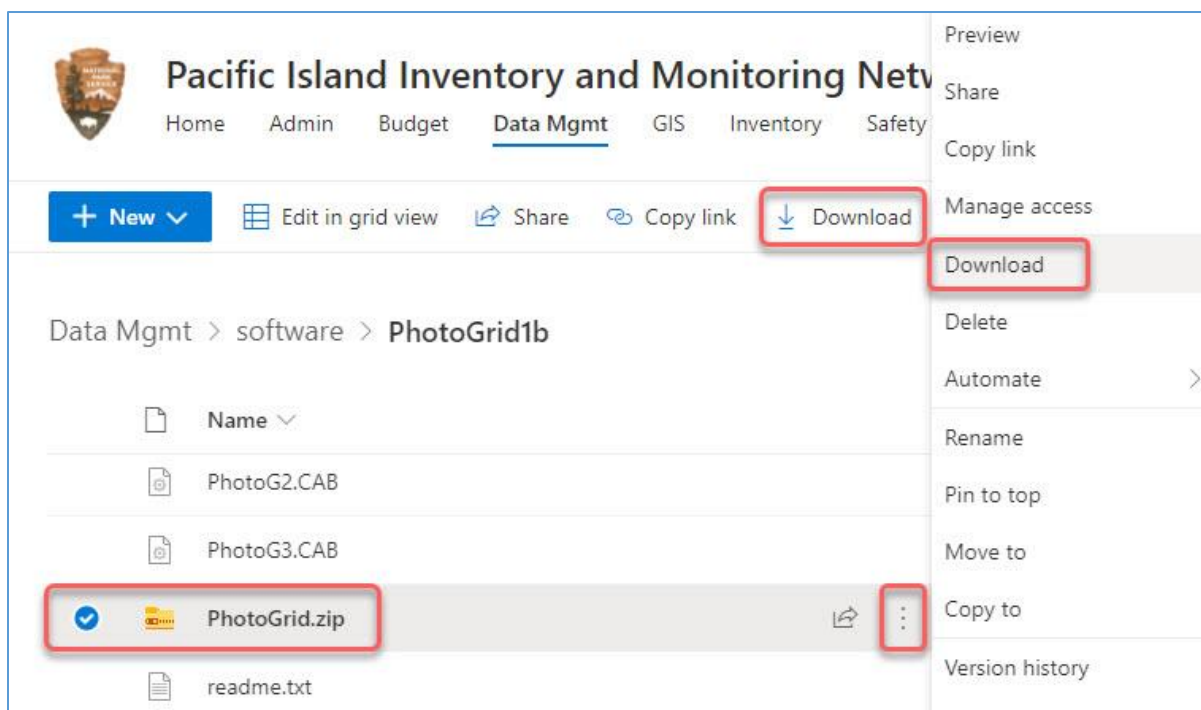


Figure SOP 16.2. Downloading the PhotoGrid® ZIP (.zip) file from SharePoint.

3. A message will appear in the Downloads prompt in the top-right corner of SharePoint asking if you want to open the file or save as. Choose “**Save as**” (Figure SOP 16.3).

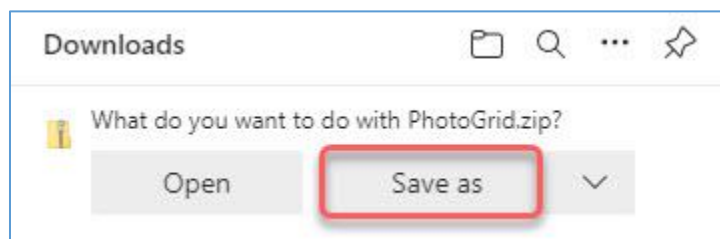


Figure SOP 16.3. Saving the PhotoGrid® ZIP (.zip) file.

4. A window will open prompting you to select a location to save the file. Navigate to the user’s Desktop (e.g., C:\Users\[UserName]\Desktop\) and click “**Save**” (Figure SOP 16.4).

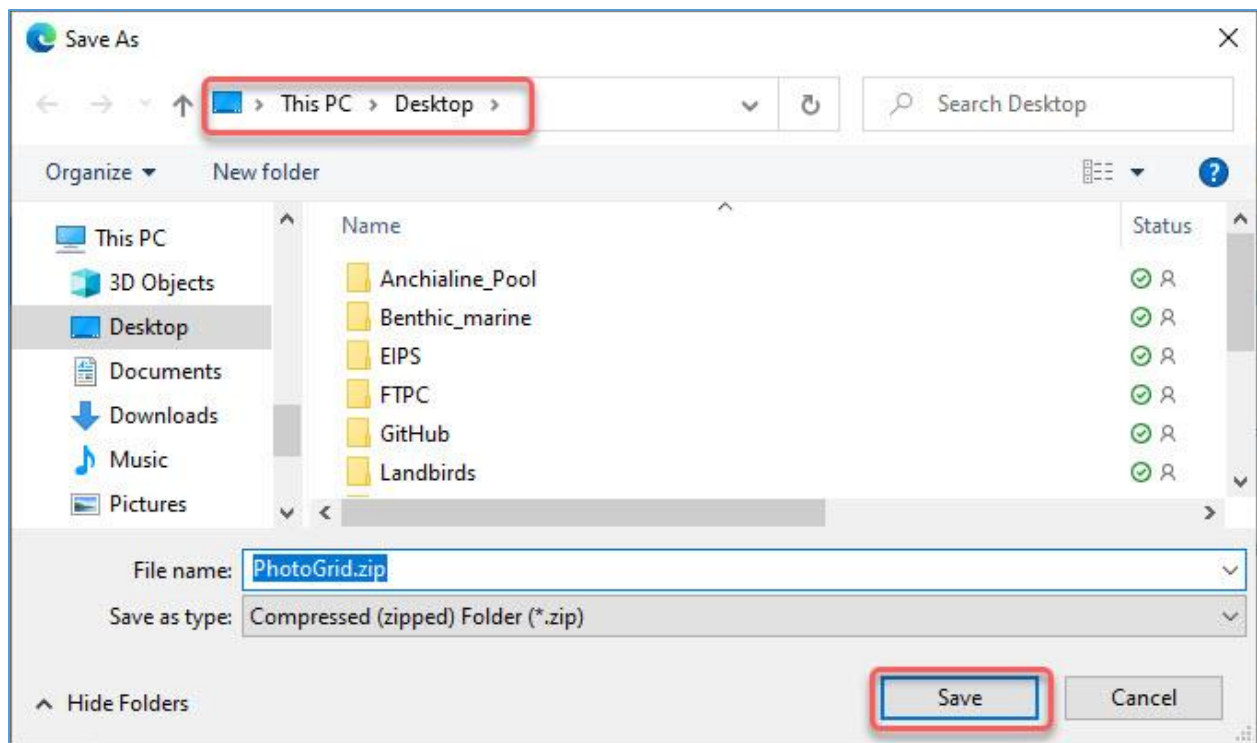


Figure SOP 16.4. Saving the PhotoGrid® ZIP (.zip) file to the user's Desktop.

5. Navigate to the user's Desktop and extract/unzip the contents of the zipped file:
 - a. In Microsoft Windows® 10, **right-click** on “**PhotoGrid.zip**” file that was downloaded to the user's Desktop and choose “**Extract All**”. This will create the necessary files (e.g., setup.exe) used in the installation process (Figure SOP 16.5).

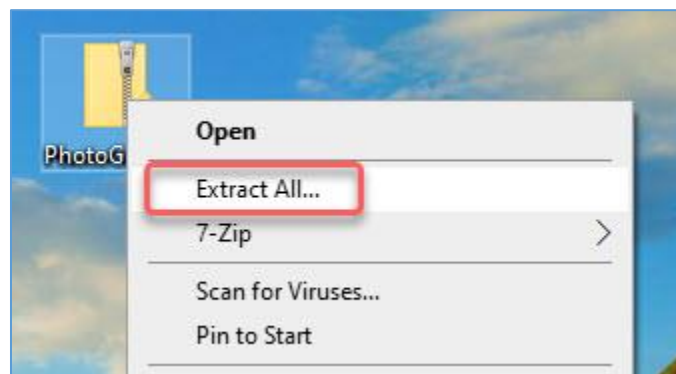


Figure SOP 16.5. Extracting the contents of the downloaded PhotoGrid® ZIP (.zip) file from the user's Desktop.

6. A window will open to choose the location for the unzipped/extracted files. Maintain the default Desktop location and click “**Extract**” (Figure SOP 16.6).

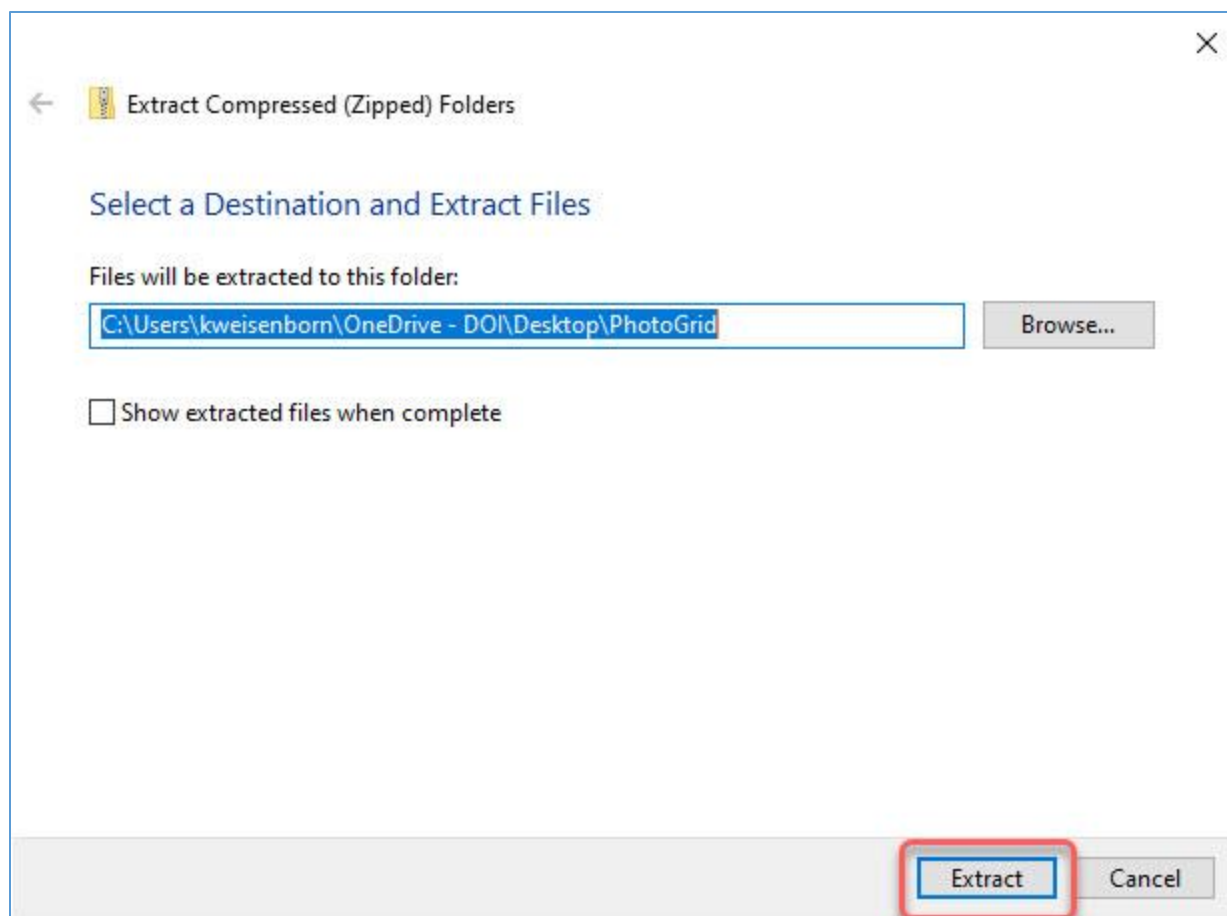


Figure SOP 16.6. Saving the extracted files on the user's Desktop.

7. Create a [NPS IT Helpdesk](#)² ticket to install the software, noting the file location of the downloaded software for installation in the ticket. Refer to the [SOP How to Submit a Support Request Using the Customer PWR Service Desk](#) for guidance on submitting a helpdesk ticket.

Species Buttons

1. Navigate to the “[Species Buttons](#)” folder in the [Benthic Marine Community project workspace](#) in SharePoint.
 - a. Select the species button that you want to download. There are two options for downloading the file:
 - i. Choose the “**Download**” button in the library’s navigation bar.
 - ii. Click the vertical ellipse  next to the filename and select “**Download**” (Figure SOP 16.7).

² NPS IT Helpdesk, <https://npshelpdesk.nps.gov/> (accessed 22 July 2022).
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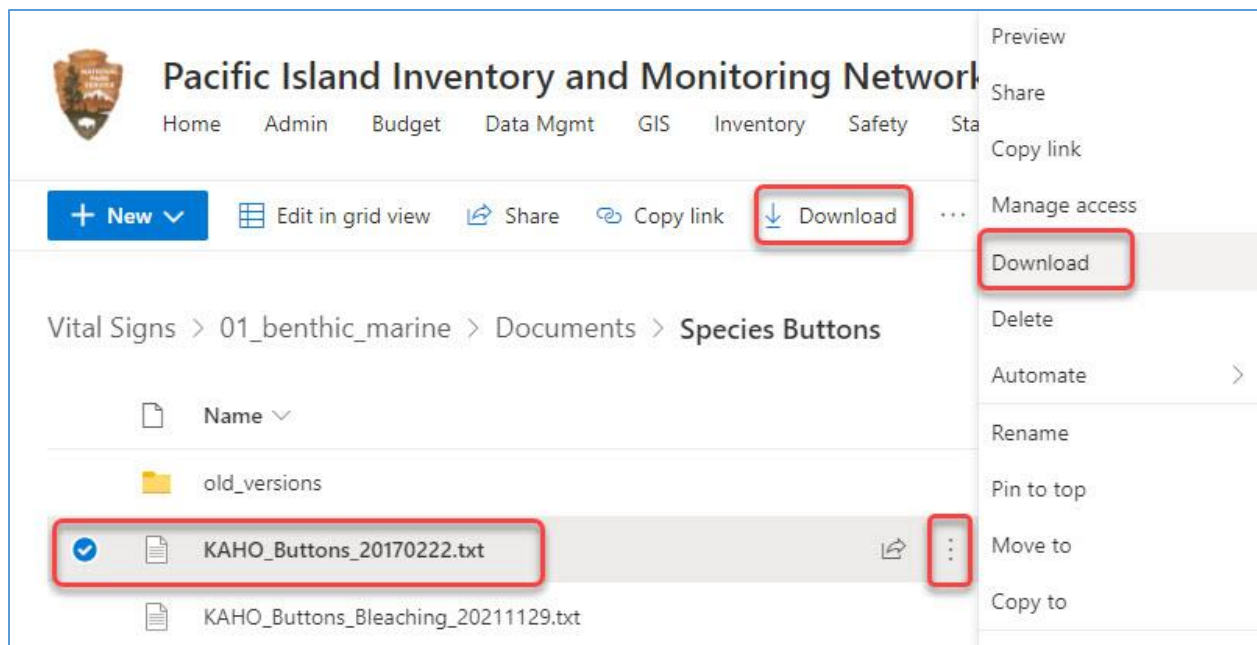


Figure SOP 16.7. Downloading the species buttons for a particular park from SharePoint.

- iii. A message will appear in the Downloads prompt in the top-right corner of SharePoint asking if you want to open the file or save as. Choose “**Save as**” (Figure SOP 16.8).

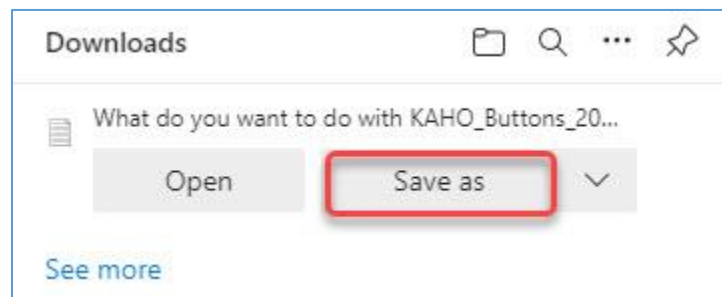


Figure SOP 16.8. Saving the species button file to the user’s local workstation.

- iv. A window will open prompting the user to select a location to save the file. Create a new folder called “Species Buttons” in your project Desktop folder (e.g., C:\Users\[UserName]\Desktop\Benthic_marine\Species Buttons). Navigate to that folder and click “**Save**” (Figure SOP 16.9).

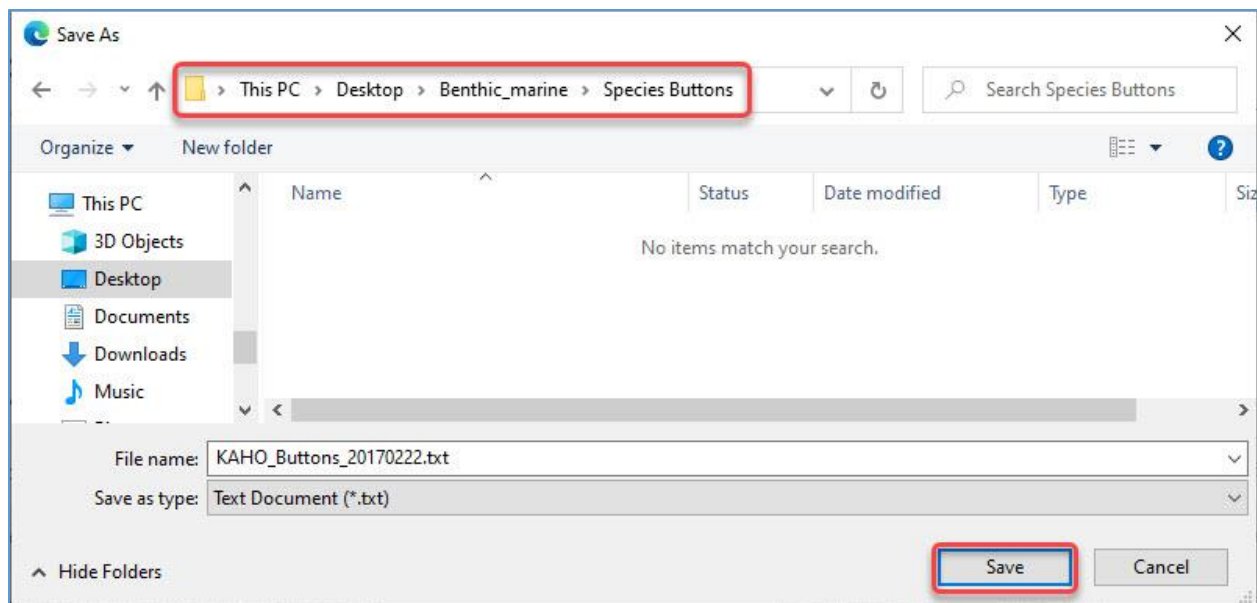


Figure SOP 16.9. Location on the user's local workstation of where to save the species button files.

- b. If new species are detected during surveys, contact the PACN Data Manager who will add the new species to the species button file.
2. The PACN Data Manager will edit the species button files using the following steps:
 - a. Open one of the species button text files using a text editor such as Notepad®, Wordpad®, or Word®.
 - b. Edit the text file to incorporate the species within the park (Figure SOP 16.10).

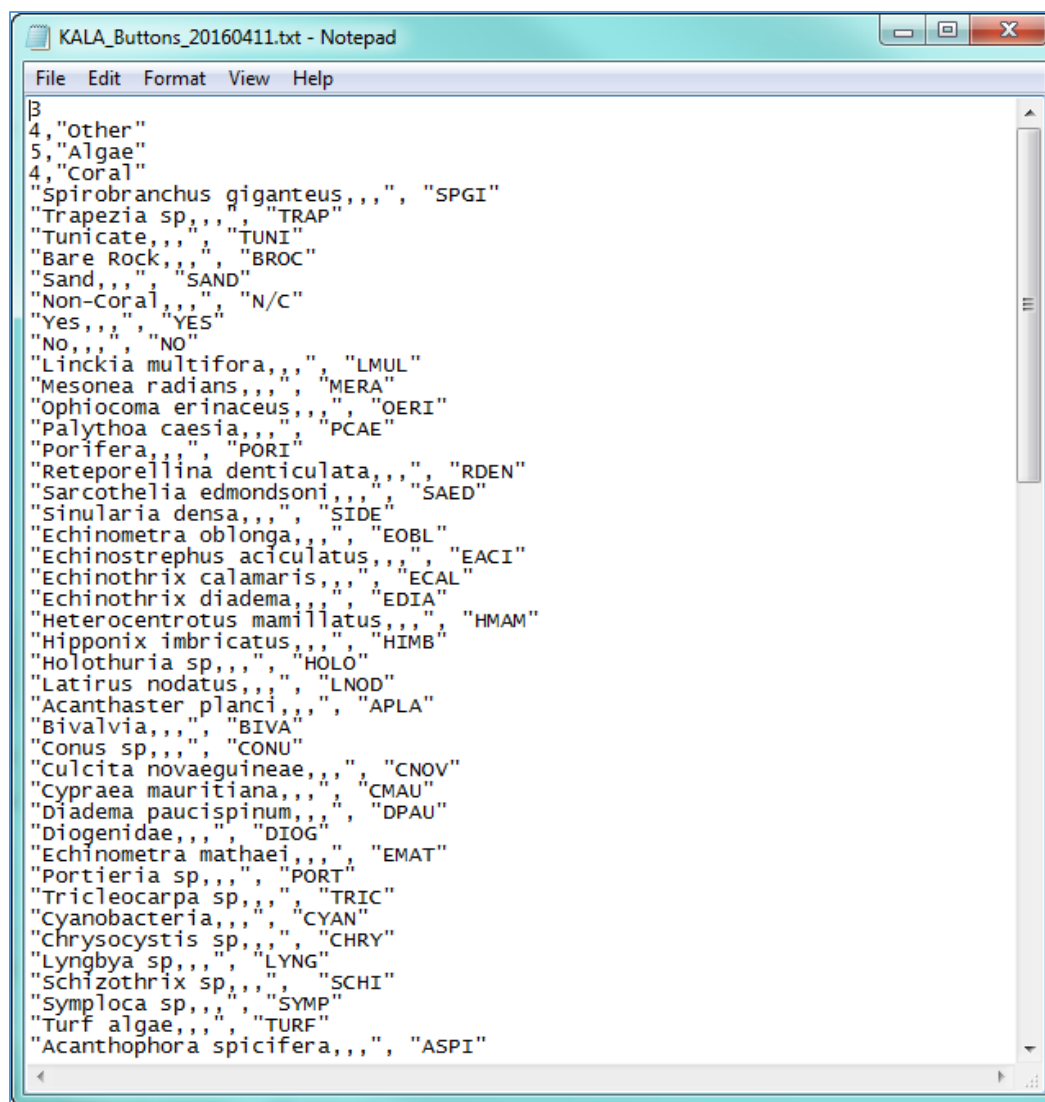


Figure SOP 16.10. Sample PhotoGrid® species buttons text file showing format for taxa entry.

- c. Save the text file in the “Species Buttons” folder in your project Desktop folder (e.g., C:\Users\[UserName]\Desktop\Benthic_marine\Species Buttons).
- d. Upload the edited species button file to SharePoint:
 - i. Navigate to the “[Species Buttons](#)” folder in the [Benthic Marine Community project workspace](#) in SharePoint.
 - ii. From the toolbar at the top, click “**Upload**” > “**Files**” in SharePoint (Figure SOP 16.11).

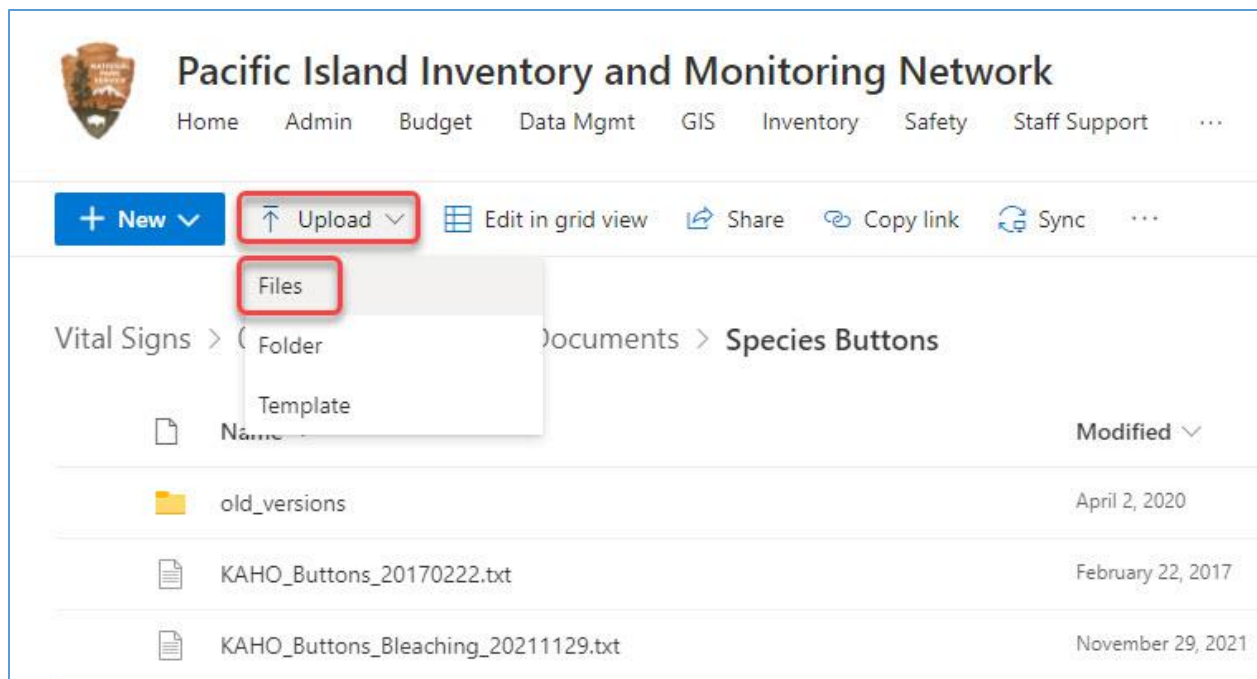


Figure SOP 16.11. Uploading the edited species button back to SharePoint.

- iii. A window will open prompting you to select the file from your PC that you want to upload to SharePoint. Navigate to the “Species Buttons” folder in “Documents” folder (e.g., C:\Users\[UserName]\Documents\Species Buttons), select the species button that you just edited and then click “**Open**” (Figure SOP 16.12).

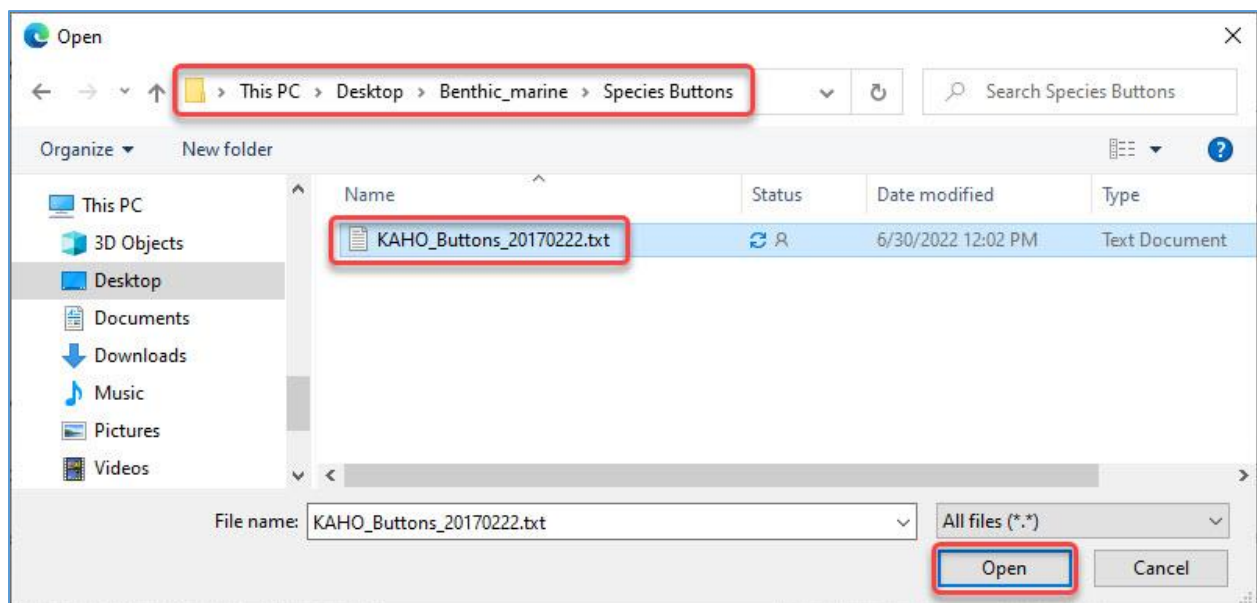


Figure SOP 16.12. Uploading the species button file from the user’s local workstation to SharePoint.

- iv. The files will upload, and a confirmation message will appear.

- v. If you are uploading an existing file, then you will receive a message asking if you want to replace the file or keep them both.
 1. Select “**Replace**” to overwrite the existing file and add the new file as the latest version. This will move the overwritten file to the version history. **Note:** This is the preferred method unless there is a specific reason to have two copies of the file.

Using PhotoGrid

1. Launch PhotoGrid® by clicking on the Microsoft Windows® search icon  on the bottom-left of the task bar and typing, “**PhotoGrid**”. The PhotoGrid® app will show in the search results, click on the PhotoGrid® app (Figure SOP 16.13).

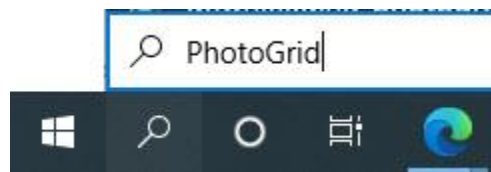


Figure SOP 16.13. Launching PhotoGrid® software application from user’s PC.

2. Once open, on the top-left of the PhotoGrid® program, click “**Options**” → “**Preferences**” to open the Preferences window (Figure SOP 16.14).
3. In the Preferences window, set the following settings:

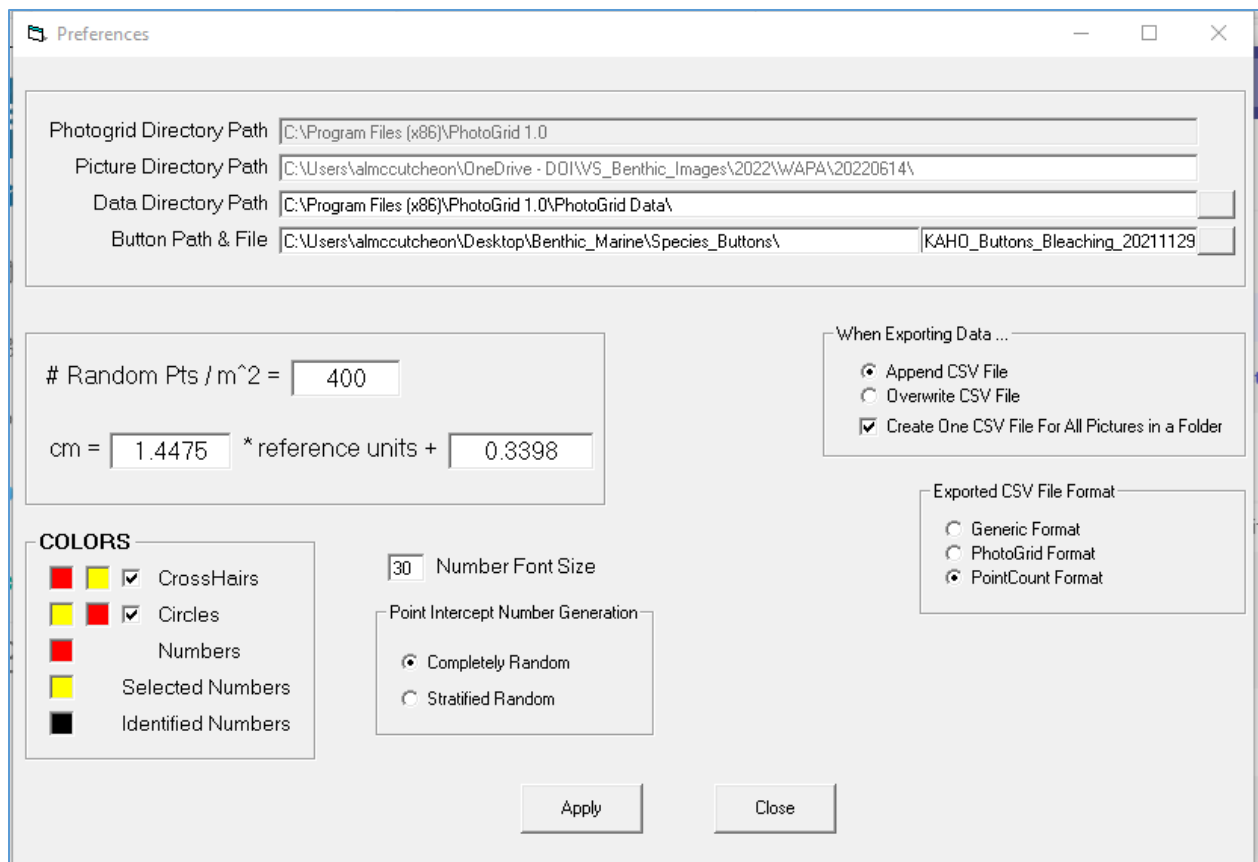


Figure SOP 16.14. PhotoGrid® preferences screen under the “Options” menu.

- a. In the *Data Directory Path* field, select which folder to save data files. The default folder is the “C:\Program Files (x86)\PhotoGrid 1.0\PhotoGrid Data” folder. To change the folder, click on the box to the left of the *Data Directory Path* field and navigate to the preferred folder. These data files will have the extension “.PGC”.
- b. In the *Button Path & File* field, select the folder path for the location of the species button files on the user’s local workspace (e.g., C:\Users\[UserName]\Desktop\Benthic_marine\Species Buttons). In the example in Figure SOP 16.14, the user has the species button files saved on their OneDrive Documents folder.
 - i. Select the species button file that will be used for substrate identifications within the park. In the above example, “KAHO_Buttons_Bleaching_20211129.txt” is the file that has the species/substrate codes used for Kaloko-Honokohau National Historical Park.
- c. Under the *When Exporting Data* section, select “**Append CSV file**” and “**Create One CSV File for All Pictures in a Folder**”.
- d. Under the *Exported CSV File Format* section, select “**PointCount Format**”.

- e. Under the *Colors* section, note that the current point (i.e., Selected Numbers) will be highlighted in yellow with completed points (i.e., Identified Numbers) labeled black and points yet to be identified still (i.e., Numbers) in red. You can customize these settings to your personal preference.
 - f. Disregard the # *Random Pts/m²* section because the number of points projected on the screen will be entered on the main screen after an image has been loaded.
 - g. Apply any changes to the screen by clicking “**Apply**” and then close the window by clicking “**Close**”.
4. Under the “**Options**” menu, ensure that the “**Sampling Mode**” is set to “**Point Intercept**” (Figure SOP 16.15) which is the default.

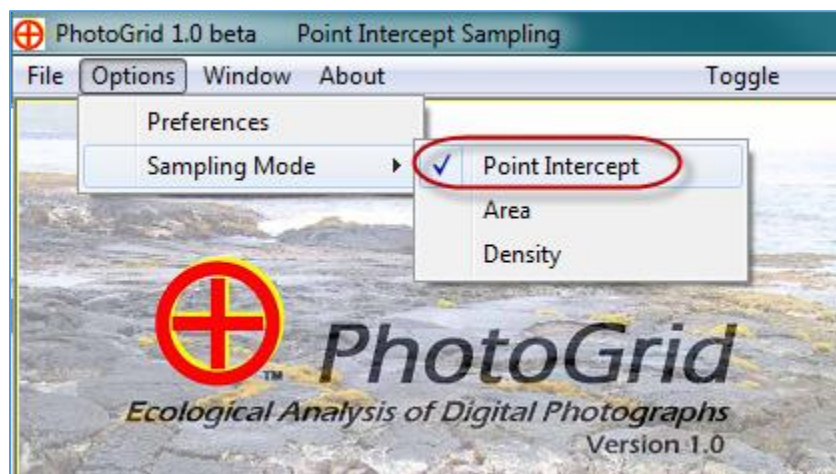


Figure SOP 16.15. PhotoGrid® sampling mode screen under the Options menu.

PhotoGrid Analysis

Important note: The correct folder location for the images that are to be analyzed is the “[Images](#)” folder in SharePoint. In order to analyze images in PhotoGrid®, a shortcut must be created on the user’s OneDrive, which also involves renaming this folder to “VS_Benthic_Images” on the user’s OneDrive. See [SOP #12 Workspace Setup and Project Records Management](#), “Creating Shortcut to Image Files for Analysis” section for instructions on how to create a shortcut prior to analyzing the images.

To perform Benthic Image Analysis in PhotoGrid®:

1. Add the OneDrive shortcut images sampling event folder to the user’s device so that analyzing images in PhotoGrid® is quicker:
 - a. Open File Explorer and navigate to C:\Users\[UserName]\OneDrive - DOI\VS_Benthic_Images → Year folder → Park folder → “Data” folder (Figure SOP 16.16).

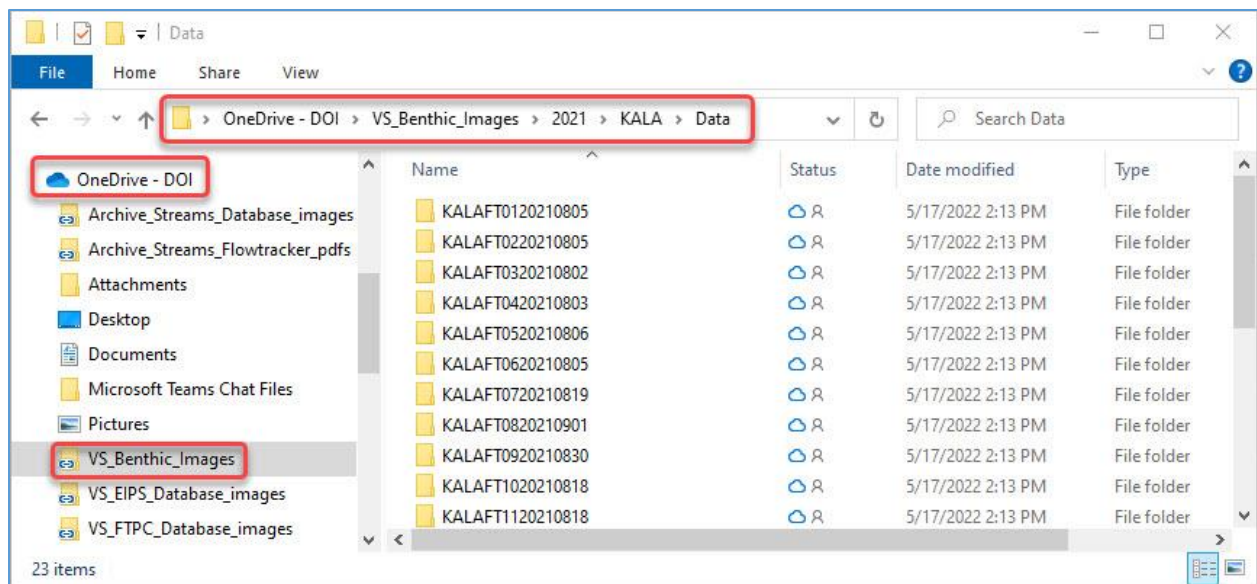


Figure SOP 16.16. Navigating to the “Data” folder on the user’s OneDrive benthic images shortcut in File Explorer.

- b. In the “Data” folder, right-click on the sampling event folder for the images to be analyzed and select “**Always keep on this device**” (Figure SOP 16.17).

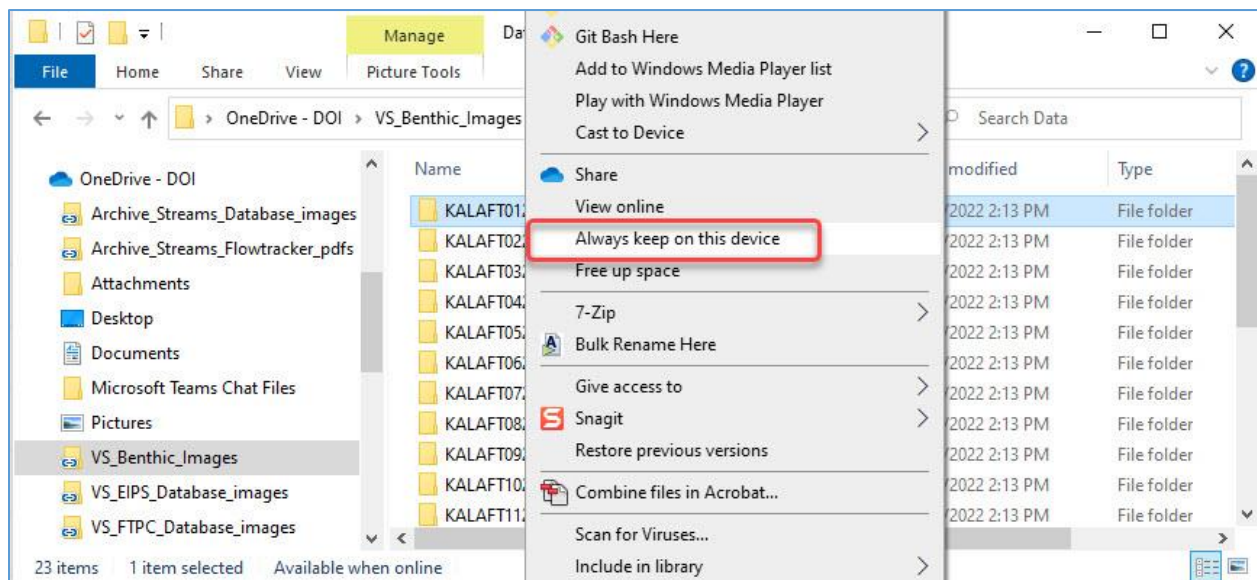


Figure SOP 16.17. Adding a sampling event folder to the user’s device.

- c. Once added, the status icon to the right of the folder will turn from  (stored in the cloud) to  (downloading), and finally to  once all contents of the folder have been downloaded to the device.

2. On the menu select “**File**” → “**Open**” and navigate to the user’s OneDrive shortcut images sampling event folder that was just added to the device in Step 1 (e.g.,

C:\Users\[UserName]\Desktop\Benthic_marine\Images → Year folder → Park folder → “Data” → sampling event folder). Select the image to be analyzed (Figure SOP 16.18).

- a. Start with the first frame of the transect (000), identified by the last three digits of the file name, i.e., KALA21FT01000.

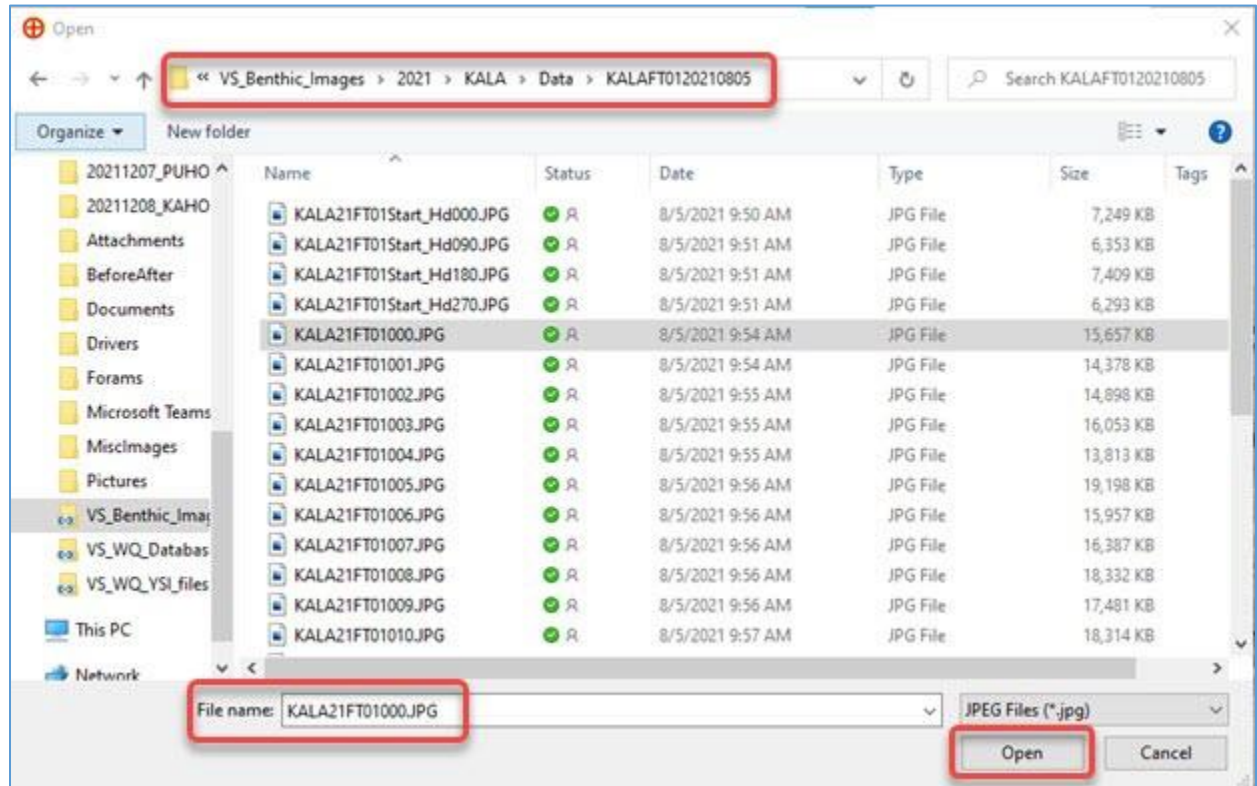


Figure SOP 16.18. Choosing an image to be analyzed in PhotoGrid®.

3. In the lower left-hand corner of the main screen set the number of random points (i.e., # Rand Pts) to be generated depending on whether bleaching data is to be collected (Figure SOP 16.19):
 - a. **Original** – set to 51
 - b. **Bleaching** – set to 52
4. Press the “**Generate RandPts**” button to generate the 51 (Original) or 52 (Bleaching) points on the image (Figure SOP 16.19).

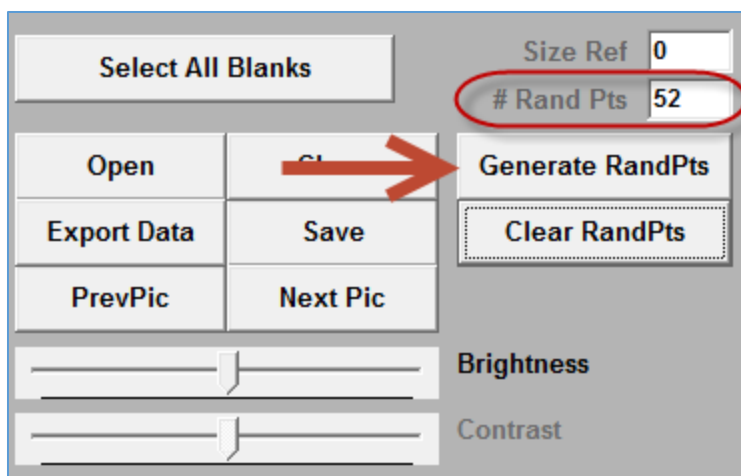


Figure SOP 16.19. Generate the random points to be analyzed.

5. The cursor appears in the blank space for point number one and will advance automatically as subsequent identifications are made.
6. Fill in the PhotoGrid® table on the left side of the screen using the buttons corresponding to the substrate type at the bottom of the screen. The pixel used to make the identification is in the lower right-hand quadrant of the **+** symbol (Figure SOP 16.20).

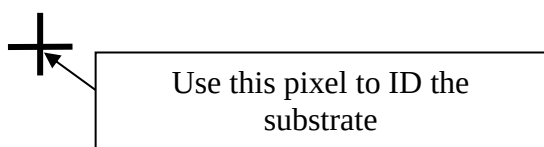


Figure SOP 16.20. Location of pixel used to make identification of substrate type.

- a. Bleaching – for coral species, bleaching data will need to be entered, which will go in the field with the coral species name on the left side of the screen (Figure SOP 16.21).
 - i. Coral species all have a default value of “No” for coral bleaching, which is after the first comma after the species name.
 - ii. If there is bleaching, replace “No” with “Yes”, making sure it is between the first two commas. It is important that “Yes” goes between these two commas in order for the data to be exported to the correct fields.
 - iii. If there is bleaching, add the bleaching category between the last two commas. Again, this is important for exporting the data to the correct fields.
 1. “BL” for bleached
 2. “BLA” for bleached with algal overgrowth

1	Turf algae...
2	Turf algae...
3	Turf algae...
4	Porites brighami,Yes,BL,
5	Turf algae...
6	Turf algae...
7	Porites brighami,Yes,BL,
8	Echinothrix calamaris...
9	Turf algae...
10	Turf algae...
11	Montipora patula,No,,
12	Amansia sp...
13	Porites brighami,Yes,BL,
14	Turf algae...
15	Turf algae...
16	Turf algae...
17	Turf algae...
18	Echinothrix calamaris...
19	Palythoa caesia...
20	Cyphastrea agassizi,No,,

Figure SOP 16.21. Populating species fields with bleaching data.

6. To magnify a part of the screen, point the cursor in the area and left-click (once) on the mouse. To reduce the image then right-click on the mouse.
7. Clicking on multiple point numbers and then assigning the appropriate identification to them with the corresponding substrate type button allows for multiple entries (of points on same substrate type) to be made with a single keystroke.
8. When you reach point number 51 on the left side of the screen then enter "**Yes**" if coral disease or bleaching is present anywhere in the frame, or "**No**" if the corals appear to be disease free and unbleached.
 - a. Disease symptoms include lesions and rings or bands that demarcate live healthy tissue from dead tissue. Bleaching is whitening of the tissue, which signifies a loss of the symbiotic zooxanthellae. This whitening can sometimes be confused with coral disease or Crown-of-Thorns (COTS) Sea Star predation, which may show a somewhat similar pattern. At present, treat any complete whitening as bleaching. Do not indicate bleaching when the corals are pale in color. However, when observed at field sites, record the following metadata: whether or not there are multiple bleached colonies, estimated number, species affected, approximate maximum diameter of patch(es) of bleached corals, presence-absence or (preferably) estimated number of COTS, and location(s) within the site relative to the transect start point (compass bearing, approximate distance in meters). LJ Raymundo et al. 2008. *Coral disease handbook: guidelines for assessment*,

monitoring and management provides a good reference for coral diseases that may be encountered at PACN parks.

9. If bleaching data is being collected, point number 52 will be populated with the bleaching severity for the frame. This value is a visual estimate of how much of the coral in the photo is bleached. Make an estimate and choose the button with the corresponding severity range (i.e., 76-100%, 51-75%, etc.). Severity buttons are on the lower right hand side under “Other”. If there is no coral in the photo, enter “No Coral” in this field.
10. After completing the identification of all 51 or 52 points bring up the next image by clicking on the “**Next Pic**” button in the lower-left of the screen. The data for each frame is being saved automatically in a PGC file for the transect in the folder “C:\Program Files\PhotoGrid 1.0\PhotoGrid Data”, or whichever folder was designated in Step 9 of the Setting up PhotoGrid® section.
11. Repeat steps 1-11 to analyze additional benthic image sampling events.
 - a.

Identification Standards

Identify the substrate under the lower right hand quadrant of the crosshair (“+”) using the following standards (Table SOP 16.1). See [Appendix SOP 16.a](#) for examples of different substrate types.

Table SOP 16.1. Substrate identification standards.

Substrate Type	Instructions
Unnatural objects	For unnatural objects such as pin, tape, reel, you can use the N/C (non-coral) category.
Fish	Since fish are not part of the benthos, treat these as unnatural objects and select the (non-coral) category.
Other invertebrates (e.g., urchins, sea cucumbers, mollusks)	Identify to the lowest possible taxon.
Dark areas	For dark areas (e.g., shadows obscuring objects) in the image use the Subs (substrate) category
Unknown substrates	For unknown substrate use the Subs (substrate) category
Other organisms	For organisms not listed in the species button file, identify the organism to the lowest possible taxonomic group and notify the PACN Data Manager of the new species. Notify the PACN Marine Ecologist if necessary to verify the identification.
Snapping shrimp burrows	For snapping shrimp burrows in coral, use the TURF (Turf Algae) category since this category lines the burrow.
Recent broken areas	For areas of the reef that were recently broken, try to identify what it was prior to the damage. If this is not possible categorize as Unknown. In the next survey year, simply identify the new substrate (e.g., turf algae) based on whatever it now is.
Structures within algae or no structure	If structure within the algae is observable, select MALG (Macro algae) or lowest possible algal taxon. Typically, this is evaluated as height (2-3 cm) above the substrate. Use the TURF (Turf Algae) category when the substrate has no observable structure or height, and it appears like a fuzzy growth.

Distinguishing between dead coral with turf algae and macroalgae in images captured from a still photograph may be difficult but is worth taking the time to try to do accurately. The predominance
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of either category of substrate can be an important ecological indicator. Greater levels of macroalgae may reflect elevated nutrient levels, or lower levels of fish or urchin grazing (and possibly over-fishing). In comparison, increased dead coral with turf may indicate recent coral disease or high levels of grazing. Height ($\sim <2\text{-}3\text{ cm}$) and the absence of an identifiable macroalgal structure can be considered in identifying dead coral with turf. Macroalgae generally attain a height/thickness $>2\text{-}3\text{ cm}$ and may be fleshy, filamentous, or calcified, often with conspicuous branching, blades.

When deciding whether the photo point is on dead coral with turf algae or macroalgae, you will need to evaluate other areas in the image for comparison. As with the hard corals, and other sessile benthic invertebrates, algae should be identified to the most descriptive level possible, i.e., lowest taxon possible, ideally genus or species. If this is not possible, but the alga appear fleshy and to have a height $>2\text{-}3\text{ cm}$, it should be identified as “macroalgae”. As the photograph provides only a two-dimensional view of the reef, the component’s “height” can be difficult to ascertain. This is where brief field notes of quadrat macrobiota composition are very important. Looking around the image, at substrates similar to and different from the one in question, will usually aid interpretation of the substrate features (colors, shading, textures, etc.). Also referring back to any field notes will help resolve the image in a third dimension resulting in more accurate identifications. When in doubt, dead coral with turf algae may be the more conservative category to record.

Export Data from PhotoGrid

1. After analyzing all the benthic images for a transect, the Marine Biological Technician can now begin exporting the substrate identifications within each image along each transect.
2. Open PhotoGrid® if it’s not already open and bring up the first image in the first transect for the year and park analyzed.
3. Press the “**Export Data**” button in the lower left corner of the screen. This procedure appends the information to the CSV file for that folder.
 - a. **Note:** you will not receive any message that the data has been exported. Clicking the button twice will export the data again, causing duplicate records. While this will be error checked when importing into the Access® database, take care here not to export the same data more than once.
4. Click the “**Next Pic**” button to move to the second image. Click the “**Export Data**” button. This will export the data from the second image into the CSV file.
5. Advance to each successive image and export the data until you have exported data for the last image.
6. The CSV file is created in the “C:\Program Files\Photogrid 1.0\Photogrid Data” folder, or whichever folder was designated in Step 9 of the Setting up PhotoGrid® section.
7. The file naming convention for the PhotoGrid® format is: “c_TransectFolderName.CSV”. The transect folder name contains the park code, transect number, and survey date.

- a. Data are now ready to import into the Benthic Marine Community and Marine Fish Monitoring Database. Refer to [SOP #14 Data Entry, Verification, and Certification](#) and the [Benthic Marine Community and Marine Fish Monitoring Database User Guide](#) located in the “[Database documentation](#)” folder in SharePoint for instructions on importing the data into the database.
8. To close the PhotoGrid® program, select “**File**” at the top of the window, and scroll down and click on “**Exit**”.
9. The Marine Biological Technician uploads all of the PGC and CSV files for each transect that year into the year and park subfolders within the “[Photogrid_data](#)” in the Benthic Marine Community Monitoring project workspace in SharePoint (Figure SOP 16.23). These PGC and CSV files to be uploaded are located in the “C:\Program Files\PhotoGrid 1.0\PhotoGrid Data” folder, or whichever folder was designated in Step 3.a. of the [Using PhotoGrid](#) section (Figure SOP 16.14). **You will have to copy and paste the filepath into File Explorer as this is a hidden folder.** There will be one CSV file for each transect, and one PGC file for each frame analyzed.

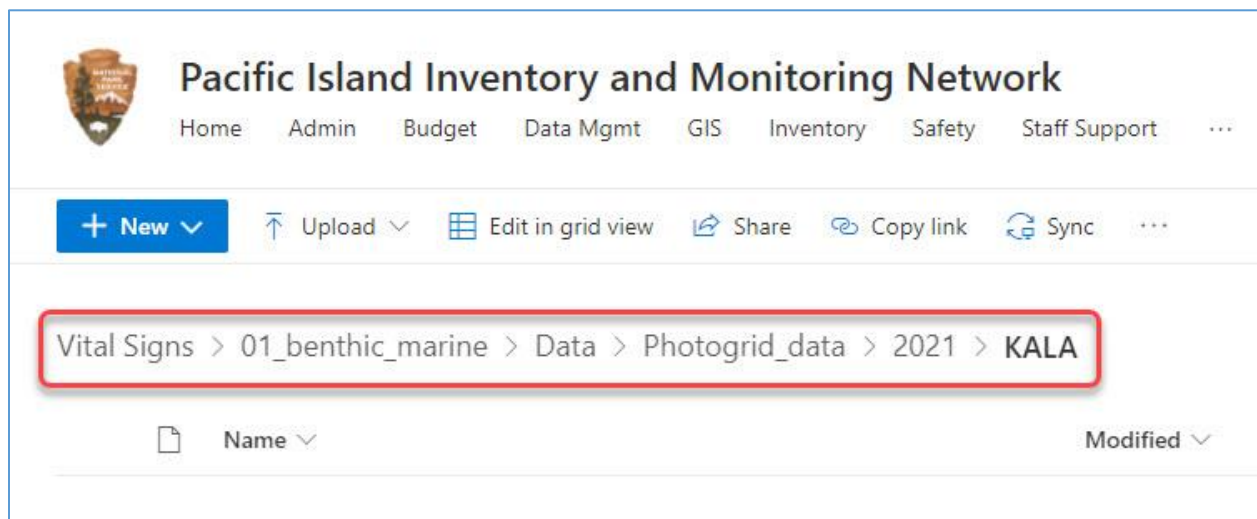


Figure SOP 16.23. Example of Photogrid data PGC and CSV file location for a particular year and park in SharePoint.

10. The Marine Biological Technician will inform the PACN Data Manager that the PhotoGrid® data is in the correct folder.
11. Once all benthic images have been analyzed and data has been exported for the sampling event, remove the sampling event folder that was added to the device in order to free up space on the user’s computer:
 - a. Open File Explorer and navigate to C:\Users\[UserName]\OneDrive - DOI\VS_Benthic_Images → Year folder → Park folder → “Data” folder (Figure SOP 16.16, above).

- b. In the “Data” folder, right-click on the sampling event folder for the images to be removed from the user’s computer and select “**Free up space**” (Figure SOP 16.22).

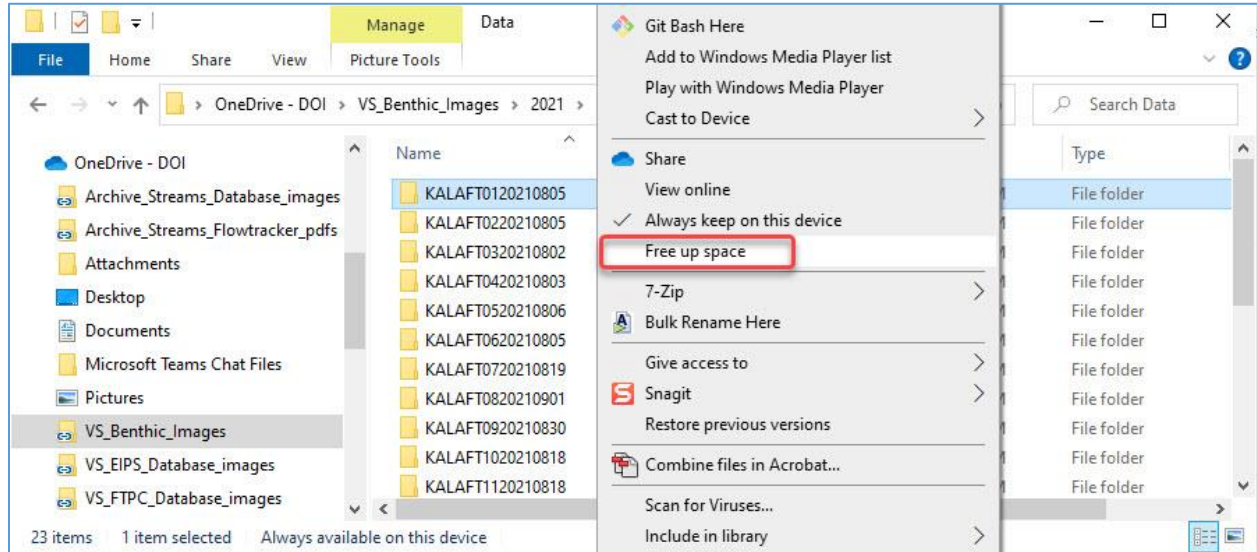


Figure SOP 16.22. Removing downloaded images from the user’s computer.

12. Once removed, the status icon will revert to .

Data Certification

Certification is the process of checking substrate identifications for 10% of the images. The Marine Ecologist at each park or the PACN Marine Ecologist is responsible for completing this task (refer to [SOP #14 Data Entry, Verification, and Certification](#)).

The PACN Data Manager will randomly generate the transects to be checked by the PACN Marine Ecologist after receiving notice from the Marine Biological Technician that the annual CSV files are saved in year and park subfolders within the “[Photogrid data](#)” folder in the Benthic Marine Community Monitoring project workspace (Figure SOP 16.23, above).

1. The PACN Data Manager will import the data in the CSV files into the working copy database for the sampling year for each park (i.e., KAH0_2021_benthic_fish_be_working_copy.mbd).
 - a. To import the data, open the Benthic Marine Community and Marine Fish Monitoring Database front-end database file and link to the appropriate working copy database back-end file. Proceed to import the CSV files exported from PhotoGrid®. See the [Benthic Marine Community and Marine Fish Monitoring Database User Guide](#) for instructions on first downloading the database files to the user’s local workstation, and then on importing the data.
2. The PACN Data Manager will randomly select 10% of the images (~75 images per year) for re-examination and certification by the PACN Marine Ecologist.

3. The Benthic Marine Community and Marine Fish Monitoring Database has a proofing form that will randomly generate the transects to be re-examined.
 - a. In the front-end database, click the Proof Benthic Data button on the database's main switchboard to run the proofing tool. See the [Benthic Marine Community and Marine Fish Monitoring Database User Guide](#) for instructions for instructions on how to use the tool.
4. The PACN Data Manager will inform the PACN Marine Ecologist which transects are to be re-examined for certification.
5. The PACN Data Manager will compile PGC and CSV files for the transects selected for certification. These files will be uploaded to the “Pre-certification” folder in the year and park subfolders within the “[Photogrid data](#)” folder in the Benthic Marine Community project workspace in the SharePoint (Figure SOP 16.24). These files will be re-examined by the PACN Marine Ecologist.

Keeping these files separate will keep a record of pre-certified data and certified data to archive.

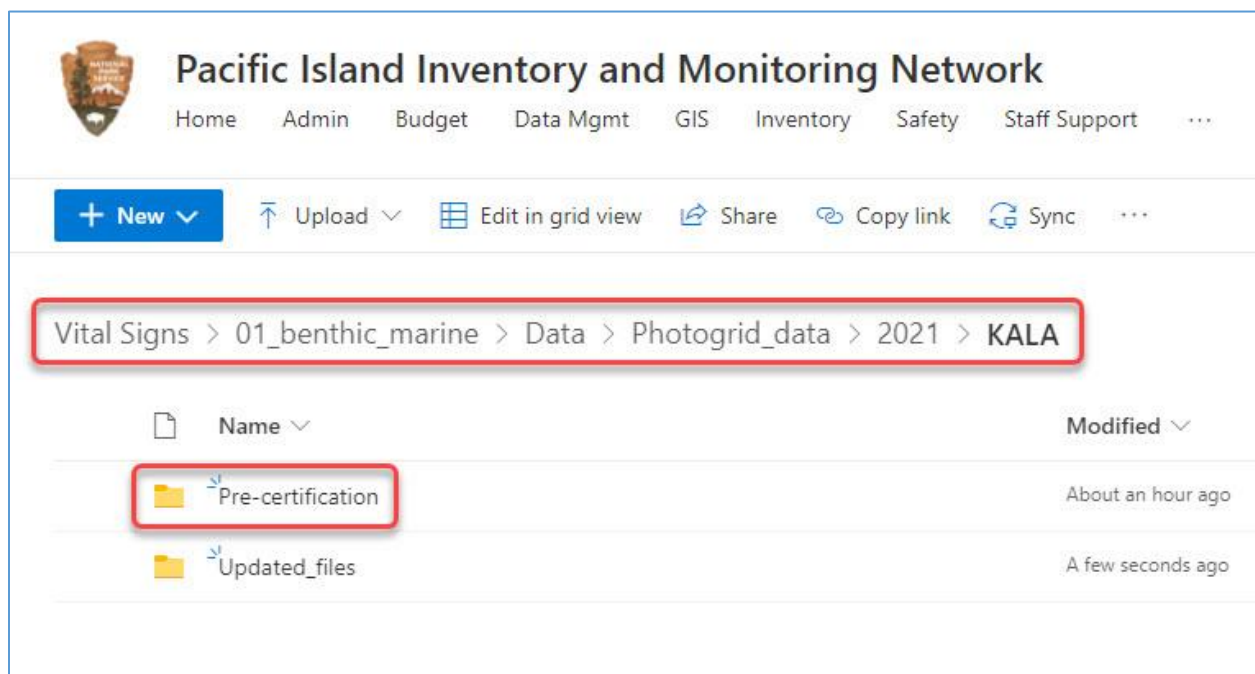


Figure SOP 16.24. Example of folder location for PGC and CSV files for the transects selected for certification for a particular year and park in SharePoint.

6. The PACN Marine Ecologist should copy the PGC files for the randomly generated transects to be certified to the “C:\Program Files\PhotoGrid 1.0\PhotoGrid Data” folder on their PC.
7. The PACN Marine Ecologist conducting the re-examination verifies that the correct substrate identifications have been recorded on the screen.

8. If corrections need to be made, then the PACN Marine Ecologist updates the PhotoGrid® screen and logs the transect and image number using the Error Checking Data form in [Appendix SOP 16.b](#). Logging the information will allow measurement error to be estimated.
9. Updating the screen identifications also updates the PGC files.
10. If the substrate identification error (overall measurement error for the 75 images) is lower than 10% (~375 total points) then the updated PGC and CSV files can now be sent to the PACN Data Manager for upload to the working copy database.
11. If the substrate identification error (measurement error) is higher than 10% then the errors need to be evaluated and corrected. For example, consistent misidentification of certain taxa would necessitate the Marine Biological Technician going back and updating all of the images with the correct information.
 - a. Once the errors have been resolved at the Marine Biological Technician level, export the data using the previous steps for exporting the data, and upload updated PGC and CSV files to the “Updated_files” folder in the year and park subfolders within the “[Photogrid_data](#)” folder within the Benthic Marine Community project workspace in the SharePoint (Figure SOP 16.25).

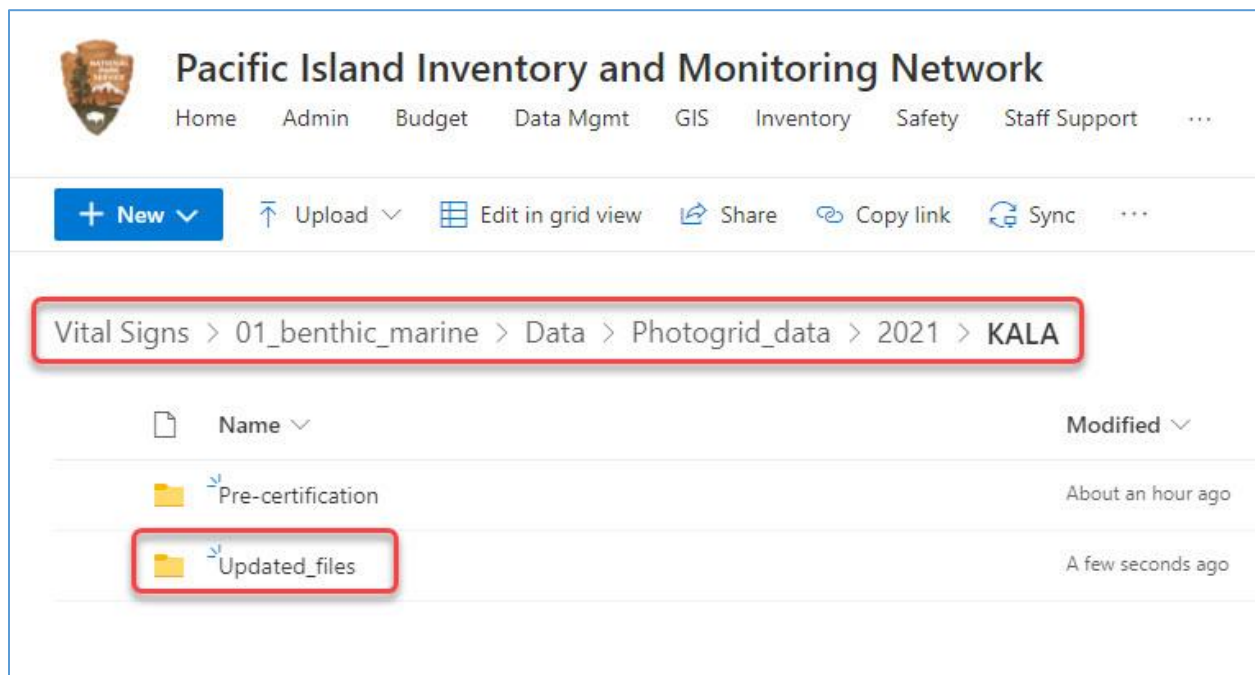


Figure SOP 16.25. Example of folder location for updated PGC and CSV files for a particular year and park in SharePoint.

- b. The PACN Marine Ecologist will re-examine 10% of these updated records, using the same process as before.
12. Substrate identification error must be lower than 10% in order to consider the data certified.

Appendix SOP 16.a. Substrate examples

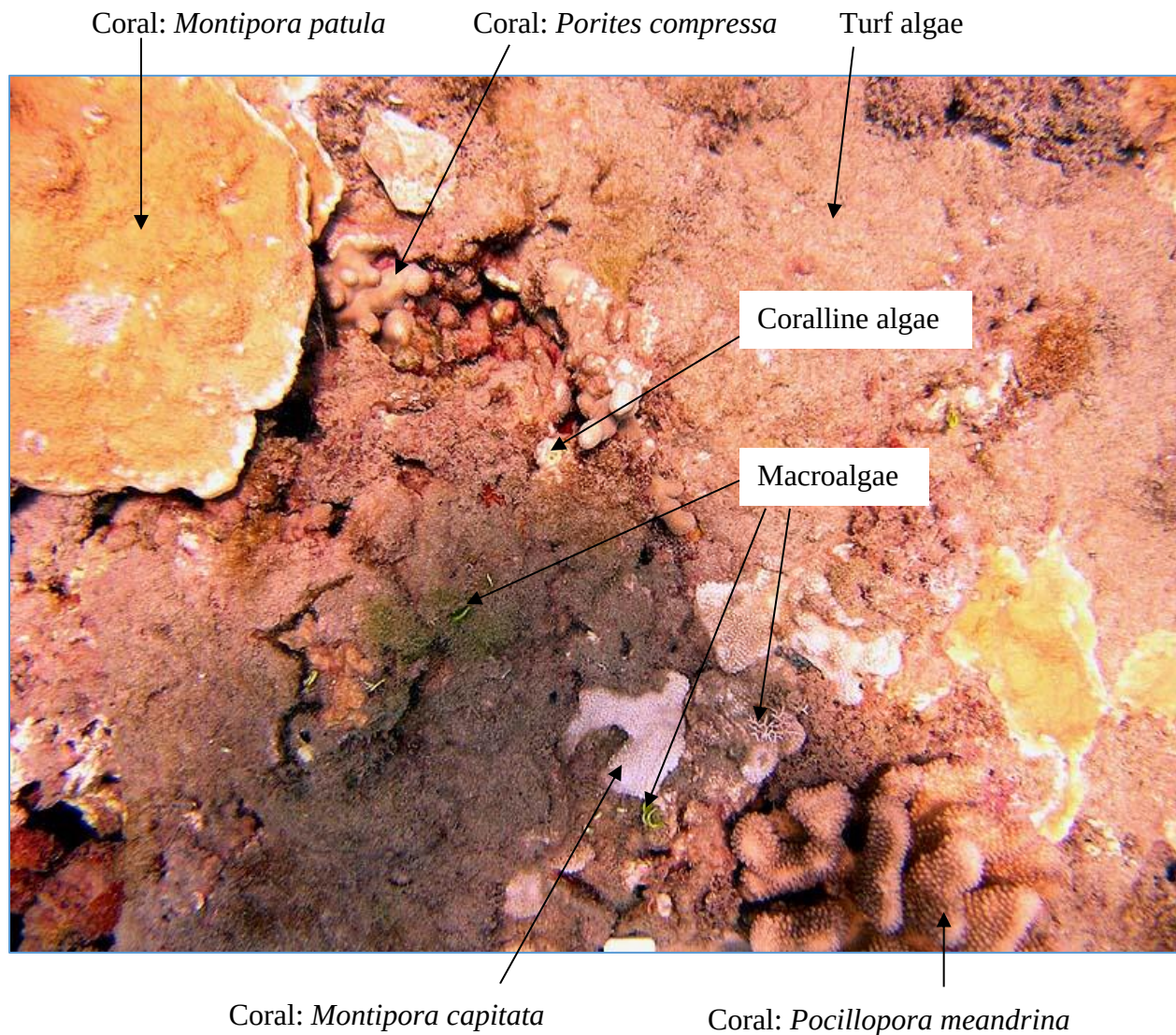


Figure SOP 16.a.1. Examples of substrate types from digital still images from Hawaii.

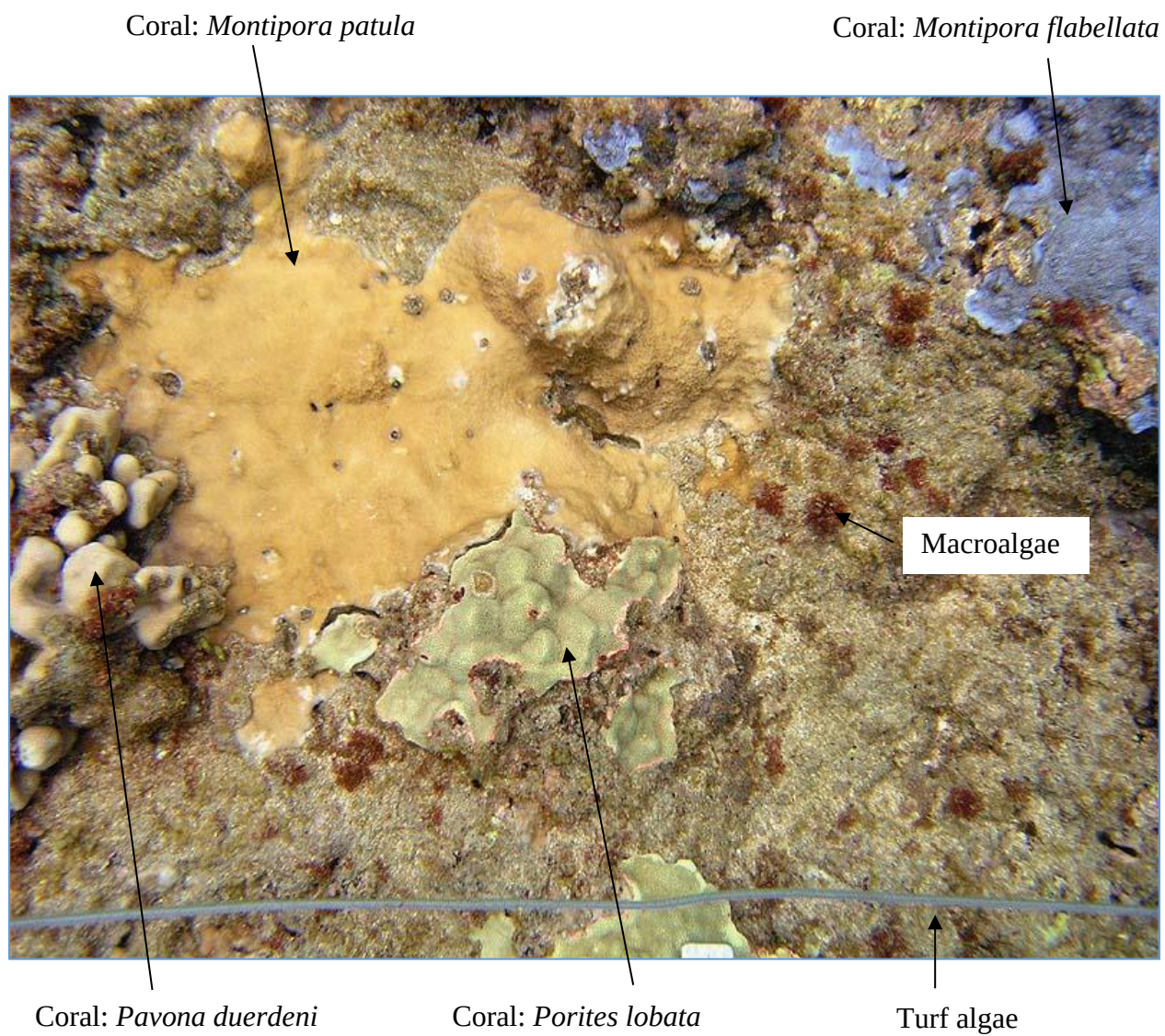


Figure SOP 16.a.2. Examples of substrate types from digital still images from Hawaii.

Appendix SOP 16.b. Error Checking Data Form

Data form for error checking of point identifications in photoquadrat images

Year:

Photogrid IDer:

Park:

Total Number of Images Checked:

Marine Ecologist:

Total Number of Points Checked:

Events	Transect	Image	Point #	Incorrect Substrate	Correct Substrate
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
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18					
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