The Video Method for Measuring Benthic Cover on Coral Reefs: An Overview.

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Photography provides the only practical means of sampling large areas underwater, given the constraints of scuba diving. High-resolution video technology makes the approach all the more attractive because videotaping is easier and less time-consuming then still photography. While still photographs provide better resolution than videotapes, the resolution of digital videotapes are adequate for this type of work. Videotapes enable the investigator to cover a far greater area per unit sampling effort. In addition, video exposures are automatic, continuous and do not require developing.

In this method, a diver swims slowly along the transect, videotaping a swath of the reef (approximately 40 cm wide) from a height of approximately 40 cm, using a high-resolution digital video camera in an underwater housing, fitted with a wide-angle lens. A "red-filter" is available for use on deeper transects to enhance color and identification.

Later in the office, analysis will be conducted as follows:

> Individual video frames are displayed on a television (monitor). A clear plastic sheet with 10 random "dots" is laid over the monitor screen, and the sessile organisms (or substrait) underlying the "dots" are recorded. The videotape is then advanced to a new, non-overlapping position. Thus, each transect yields a number of unique "captured" images, or video "quadrats", for a total of several hundred points per transect. The point count data can be used to calculate percent cover.

With this video method, holding the camera perpendicular to the substratum, swimming slowly along the transect, it is possible to produce clear stop-action images. Coral, sponges, and some gorgonians and macroalgae can be identified. Bottom types that cannot be identified are lumped into a single category.

Field time available for videotaping is dependent on the depths of the transects, however, generally five 20 meter transects can be taped in one hour of battery power (conveniently, digital tapes hold approximately 60 minutes). During analysis, approximately 60-120 minutes is needed for data collections of each 20-minute transect. Eventually the cataloging and archiving of the data and tapes will produce a substantial library that can provide stastically sound, and comparable data for many years to come.

Figure 1: James Azueta with Sony DCR_VX 1000digital video camera in a L&M Stingray u/w housing, recording coral reef features under a 20 m transect marked with a measuring tape. J.D. Woodley photo.

PROTOCOLS FOR VIDEO METHOD
Equipment Preparation and Handling

I) Materials and Equipment: excluding standard dive equipment

Video Materials:

Camera and Accessories

1. Sony DCR-VX1000 Digital Video Camera
2. mini digital video cassette tapes
3. video batteries (previously charged)
4. SONY AC-V515 AC power adapter/battery charger
5. Eye piece

http://www.sel.sony.com/SEL/consumer/camcorder/dcr_vx1000.html

Housing and Accessories

1. Stingray (Light & Motion brand) underwater camera housing
2. two straps fastened around housing (modified BCD)
3. distance aiming wand (app: 70 cm)
4. red lens cap
5. two rear plate active-use o-rings (black)
6. two rear plate storage o-rings (red)
7. silicone grease
8. cotton "Q-tip" swabs

http://www.lmindustries.com/us/form_info_image.htm

Miscellaneous Underwater Equipment

1. video slate (Magnadoodle type), with pen/pencil attached
2. 1-3 (depending on site) transect tapes
3. clipboards
4. mylar
5. pencils
6. rubber bands

II) Video Housing Equipment Preparations:

(NOTE- see Light and Motion Housing manual for more details)

1. The day before the scheduled outing, place the video batteries on charge. Batteries with the "green tab" exposed are fully charged. If the batteries have been previously charged, and left un-used, they may discharge during use slightly faster than normal. For example: batteries and mini-cassettes both last approximately 60 minutes. A charged

battery that has sat for several days, may provide power for only 45-50 minutes. According to information provided with the batteries, charging or "topping off" a partially charged battery does not affect battery life or memory.

2. Remove the back plate from the Stingray video housing.

3. Use your fingers, or a blunt wooden object **BUT NEVER, EVER A SHARP POINTED OBJECT**, to remove the two red storage o-rings from the grooves in the back housing plate.

4. Clean the grooves of the back housing plate and the O-ring sealing surface (located at the very back of the camera housing) with cotton swabs.

5. Clean the two black active-use O-rings. Inspect the O-rings for any nicks or signs of wear. Replace with new O-rings, if necessary.

6. Apply a dab of silicone grease on your thumb and index finger, then rub this onto the active-use O-rings. Inspect the O-rings again for any imperfections or any dirt, lint or hair that may adhere to them. The silicone should make the O-rings "shiny". It should not be visible on the O-rings. (The silicone does not prevent water flow past the O-ring. It just maintains flexibility in the O-rings, allowing then to change shape in the grooves, thus creating a barrier to the water.)

7. Periodically (consult the housing manuals for actual frequency), the O-ring under the front of the housing view port (optic) needs to be inspected and cleaned, if necessary. To do this,
    a) Hold the housing so that you are looking into the optic. The "LIGHT & MOTION" logo should be at the bottom (6:00) as you look into the front port.
    b) Place your thumb on the black slider to the left (at 9:00) of the optic, and move it left.
    c) Rotate the optic **CLOCKWISE** (~90 degrees) until it stops.
    d) Pull the optic out from the housing.
    e) Secure the housing so that you may focus your attention on the front view port.
    f) Without removing the black active use O-ring, inspect it and the sealing surface for wear or any foreign matter. If you

determine it is necessary to clean, and lubricate this O-ring, proceed to step (g). If not, skip down to step (i).

g) Remove the black active-use O-ring, inspecting, and cleaning the O-ring, O-ring grove, and sealing surface on the front of the housing. REMEMBER, **NEVER, EVER USE A SHARP OR POINTED OBJECT TO REMOVE ANY O-RING**. You can apply pressure with your fingers to cause a "bubble" or "bend" in the O-ring, and then slip it out of its groove.

h) When the O-ring inspection or cleaning/lubricating process has been completed, replace the O-ring into its groove.

i) This is a good time to clean the inside of the front view port, and the red filter if necessary. Use a soft, clean, dry cloth. Use care not to rub any silicone onto the lens or filter. Spots (of dirt or other stuff) on these surfaces may cause the camera to focus on the dirt and not in the water column or bottom during videotaping.

j) Apply a thin film of silicone to the O-ring surface area, and to the sealing surface on the front of the housing. This will allow the black view port to slide more easily when re-installing.

k) Place the optic into the opening on the housing until it seats into place. There are three orientations for the optic, all of which permit the optic to be installed correctly. This is best observed by rotating the optic until it partially "drops" into the front plate.

l) Once the optic is "seated", push it into the housing. Note that this may take some force because you are engaging a bore seal on the optic. This will "fully seal" the optic into the housing and allow it to turn.

m) With the optic flush up against the housing, rotate the optic **COUNTER-CLOCKWISE** until you hear a click (~90 degrees). The black slider should move out to the left as the optic is rotated and snap back to the right when the optic is in place. You do not need to, nor should you move the black slider with your finger when installing optics. When the optic is correctly installed, it should not be possible to rotate the optic or pull it out.

8. Check the position of the straps that fasten the aiming rod to the camera housing. Make certain that you can access and activate the video control switches without interference from the straps.

9. At this point the housing is ready for the camera installation.

III) Camera preparation

1. Install a battery into the video camera. The battery door release is located at the back of the camera near the bottom left. Press down and the battery door will pop open. Align the battery properly, and slide it into the battery compartment. The battery is held in by the release clip on the back, left side of the battery compartment. (**Caution: the battery is spring loaded**. To release the battery, depress/slide the release clip (in the direction of the arrow) and the battery will pop out. Remember it is spring loaded and will come popping out of the compartment. Close the battery compartment door. It will click shut.

2. Connect the wires from the camera tray to the video camera. There are three wires that need to be attached to the camera:
   - remote/lanc chord: a thin, black wire with a plastic probe.
   - video out chord: a thicker, gray chord with a heavy RCA type male connector.
   - DC-in chord: a thick, black wire with a heavy black plastic connector with a modified "T" 4-pin probe.

   a) The lanc chord travels under that battery compartment door, between the bottom of the camera and the camera tray. It connects on the back, upper, right hole, labeled "lanc" and with a light blue ring around the fitting. To locate this hole, you may have to remove the small semi-triangle-shaped plastic fitting protector that covers the lanc and headphone connection holes.

   b) The video out chord again runs under that battery compartment door, along the right side of the camera, under the hand strap, and into the yellow RCA fitting on the upper, right front of the camera. To locate this fitting, you may need to remove the gray plastic fitting cover that protects the DC-in, S-video and RCA fittings.

   c) The DC-in chord, runs along with the video out chord, under the hand strap, to the upper, right front of the camera, into the black, rectangular connection. You can see the female mate of the modified "T" with 4 pins connection.

d) The cables should be snug to the camera, to allow for easy sliding of the camera into the housing. The cables should not be in the sliding track of the camera tray.

3. Check Camera Settings
   a) Focus: Auto or Manual
   b) Exposuer: Automatic
   c) Camera Switch on "Camera"
   d) Option Switch on Standby

IV) Installing Camera/Tray into Housing

1) With the camera mounted on the tray you are ready to put the camera/tray into the housing. Before doing so, do make sure that the camera is set up as specified earlier, a tape is in the camera, and the battery is fully charged.

   a) The camera tray is contoured at the front to allow for easier loading. Simply lay the front of camera tray into the housing and push on the back of the camera.
   b) Push the camera in until it "docks" to the front housing. You will not be able to push it any farther in when it does, nor will you be able to pull it out, for the latch will be engaged.

2) Installing the Rear Plate: When installing the back plate onto the housing, it is usually easiest to stand the housing up on end on the front optic **(with the red lens cap in place)**. It is also possible to install the plate with the housing resting normally on a table. Do what is easiest for you. Make certain that the O-rings are lubricated and clean.

   a) Place the housing in the desired position and align the pins from the back plate with the holes in the camera tray.
   b) Make sure the latches are rotated so as to expose the tracks on their underside. Rotate latches in toward yourself a full 270 degrees or until you hear a "snap".
   c) This snap signals the plate is fully seated. Note that both O-rings should be inside the tube and the latches should be parallel to the length of the tube.
   d) Inspect around the entire rear plate to ensure that the O-rings are properly sealed.

V) Housing/Camera Operation

1) All of the housing functions are controlled by four (4) bi-directional switches located on the sides of the housing. Depending on the function of the switch, it may need to be held in place to work or simply toggled.

   a) **PWR & REC/STBY Switch:**
   - **PWR**: To power up the camera, slide this switch to the "PWR" location and hold in place until the camera powers up. This may take 2-5 seconds. Once the camera is on, it will take 5 seconds before it will respond to any commands. To turn the camera off, place the switch in the "PWR" position and hold it there again (app. 5 seconds), then return. Upon returning the switch, the camera will begin its power down routine which may take a few seconds. NOTE: the camera will power itself off if no switch is activated within 3 minutes.

   - **REC/STBY**: To start recording after the power is on, simply push the switch to the "REC/STBY" switch and return it (this is called a "toggle"). The camera well begin recording as indicated in the camera's viewfinder. To stop the camera from recording, move the switch to the same position again, and return. The camera should now be in Standby. You can toggle between "Record" and Standby" at any time.

   b) **ZOOM - W&T:**
   - **Zoom in** on a subject (macro), move this switch to the "T" position and hold as long as you want the camera to zoom. As soon as you return the switch, the camera will stop zooming.
   - **Zoom out** (wide angle) from a subject, move the switch to the "W" position and hold for the duration of your zoom.

   c) **WB & AF:**
   - **WB**: The "WB" switch allows you to toggle through the various White Balance settings of your camera. If there is no icon in the upper-left corner of your viewfinder, you are in auto mode.

   - **AF**: Holding the AF switch forward puts the camera into "momentary" Auto Focus (AF). The camera will remain in AF mode as long as the switch is held. Once released, the housing electronically automatically switches the camera to manual focus.

To put the camera into auto focus at this time, the "PWR" switch must be **toggled**. BE sure to only **toggle** the switch, because holding the switch in place will turn the camera off as described above. It is important to understand that the switches always perform the function as described, regardless of what state the camera is in at the time the switch s activated.

d) **FOCUS - N&F (near & far):** This switch works in the same fashion as the zoom control, but controls the focus and the camera lens.
   - If the camera is not in manual focus, moving this switch will put it in manual focus mode.
   - To get back to Auto Focus, toggle the PWR switch as described above.

2) Using the Red Flip Filter: When recording in depths below ~20 feet, use the red filter. This serves to balance the blue - red color on the film. The internal filter is attached to a knob on the outside of the housing in the front plate. Rotate the knob in one direction moves the filter into position, while rotating it in the other direction moves it out of position. Make note on the underwater slate of when the filter is in position and when it is not.

VI) CONDUCTING UNDERWATER VIDEO-TRANSECTS

1) Attach the rope end of the transect tape to a non-living feature of the bottom, without causing harm to any biota.

2) Run the transect tape along the designated bearing for transect distance. The tape should be as close to the bottom as possible, and should not entrap or bend gorgonians, sponges etc….. It is important that the tape be straight, and taught (not moving in the surge/current). There will be gaps where the tape is off the bottom, due to bottom contours – this is acceptable. It helps if the numbers are "up", though not vital. Time spent laying the tape well will pay off in better video image and easier analysis.

3) On the video slate, provide the following information:

   a) date
   b) site name

c) transect number
d) if a red-filter is being used
e) depth (optional)
f) videographer name or initials (optional)

4) Press the record button on the housing and film the slate for approximately 5-10 seconds by holding the slate in front of the camera aiming rod. **Make certain that the camera is recording by looking into the viewfinder and looking for the red indicator light.**

5) You can pause the camera, or continue recording and move onto the transect tape.

6) Move to the beginning of the transect, holding the camera so that the 40 cm rod is just off the substrate. You will be filming with the camera pointing straight down to the bottom (careful not to tilt the camera either back-front, or side-side). The camera is also orientated so that the long axis of the video image is perpendicular to the transect tape (use the handles of the video housing for a guide). Again, **Make certain that the camera is recording by looking into the viewfinder and looking for the red indicator light**

7) When reaching a coral head, keep the camera pointed to the seafloor bottom, and move the entire housing "up" while still pointing "down", over the top of the colony, and then "down" the other side.

8) When encountering a gorgonian, do your best to keep aligned with the transect line, either moving the soft coral slightly so the camera

Figure 2: Jeff Miller demonstrating video monitoring technique. J.D. Woodley Photo.

doesn't get obstructed, or going over as if it were a solid object (see #7 above).

9) When encountering a dip, crevice, valley, or an area where the bottom drops away from the transect tape, keep the aiming rod close to the bottom with the camera in the usual orientation. However, watch that the transect tape doesn't block the lens. It may need to be moved to one side of the lens or aiming wand, making it appear that you are not following the transect tape. Just stay on the "line" that was defined by the tape before you moved it. The tape should return, or you should return the tape to the original position when possible.

10) It should take approximately 10-12 minutes to travel 20 meters. To help with the timing, you can put a watch on the video housing and watch for the distance and time traveled along the tape. After a period of taping, you will get used to the feel of this speed. It will vary with the bottom complexity.

11) You may find it easier to view the transect tape and the video "path" by looking around the housing as opposed to looking through the viewfinder. The viewfinder is small and makes depth of field difficult to distinguish.

12) At the end of the transect, keep recording, and slowly move the camera to a more horizontal view, aiming slightly downward back down the transect that you have just filmed. Swim at a comfortable rate, about 3-6 feet from the bottom, back down the tape filming as you go. This will provide a "wide-angle" view of the reef /transect. It is often difficult to get an overall view of the reef from the "aerial" view, 40 cm away, thus this swim back allows a more diver orientated perspective, important for "seeing" the reef through the tape.

13) Once back at the beginning of the transect, press the pause button on the camera to stop recording and move on to the other selected transect.

14) Alter the slate so that it reflects the accurate site to be video taped.

15) Begin the process as described in #4 above.

16) Monitor the battery strength, and the tape left time as displayed in the viewfinder. You don't want to run out of battery or tape in the middle of a transect so plan you dive and filming accordingly. Allowing for 8-10 minutes per 20 meter transect, and a minute or two for the swim back, along with 15-20 seconds for the slate introduction, five 20meter /10 ten meter transects should fit into a 60 minute tape with approximately 63 minutes of battery time.

PROTOCOLS FOR VIDEO METHOD DATA ANALYSIS

1. Log in the video tape into the "videolog master list".

2. Create/Open a/the directory with the name of the site being analyzed. Create a subdirectory with the date that the video tape was filmed. Put the date in the format: mmddyy. Proceed months 1-9 (Jan-Sept.) with a zero, ie: 012299 is Jan. 22, 1999.

3. Open a blank sheet of "paper" (ie: from MS word) to begin a Metadata file. Describe in detail, who is doing what, when. This is to aid in the management and storage of the data. For example,
   "DATE: Jeff Miller filmed the 8 transects at Bob's Reef. They are numbered 01-08. The video tape was logged in on the videolog master list, and recorded as tape number 4."
   and,
   "DATE: Ellen Link analyzed transects 01-03."

4. Open **C:\DESKTOP\DATAENTRY** to get a clean copy of the data entry sheet

(Click to download this data entry sheet in Excel format. The file is 1.3 MB in size)

5. This one sheet will be the data entry and printing results for EACH SITE. The tabs at the bottom of the spreadsheet are 01TRAN – 20TRAN: one for each of the transects at the site. There is also a Data Table spreadsheet for the intermediate storage of the compiled data, and a Print Table that tabulates data in a printable format. There is also an "extra transect" sheet in case there is more than 20 transects. It will serve as a blank template (although this is not linked to the print or data tables.

6. To begin data entry, select the tab that represents the transect that you are analyzing (01-20TRAN).

7. Enter the "metadata" in Cells B1-B8.

   a) Location (B1): give general location. For example: "The Ridge", or "SW Reef".

   b) Transect Number (B2): This corresponds to the tab number. **Make certain it corresponds to the transect that you are viewing/analyzing!**

c) Video tape number (B3): This number is written on the cassette or in the white paper liner of the cassette case. This is the number that is used to identify the tape in the video log. This number is derived from the videolog library spreadsheet.

d) Date (B4): the date that the transect was video taped. This can be found in the video log sheet or in the information on the underwater slate prior to the start of that particular transect.

e) Length of Transect (B5): Enter the length in Meters of the transect length.

f) # of data points (B6): This number is derived from the number of "frames" that are captured or grabbed along the transect and analyzed. Generally, each frame will be analyzed with ten (10) random points, therefore, if 25 captured frames are analyzed in the transect, each frame with ten dots, then the number of points equals 250 (25 x 10). **THIS NUMBER WILL BE ENTERED AFTER THE ANALYSIS.** You will have to know how many frames you captured to get this number and until you do the analysis, you won't know that value.

g) Analysis by (B7): Enter your name or initials.

h) Date of Analysis (B8): Enter the date of the analysis.

8. Place the sheet containing the random "dots" over the monitor/television screen. Position it so that the alignment marks on the sheet match with the alignment marks on the monitor/ television. This will allow another investigator to reposition this sheet in the same position.

9. Enter the number that corresponds to the number on the random "dot" sheet at the beginning of the ten data points in column "D". There is a shaded box every ten cells that will aid in finding this data entry cell.

10. In column "E", and corresponding to the first "dot" (A), of the ten data points that you are about to enter, enter the reading from the digital counter that corresponds to the exact time (hr:min:sec) and (Frame) of which you have stopped the video. This will allow you or someone else to return to this exact same point in the video.

11. Enter the Raw data:

a) Beginning with the first "dot" A, (as noted in Column "B") and continuing sequentially through "dot" J, use the identification code for the benthic group/species found directly under the "dot" on the captured image.
b) The data is entered vertically, in beginning in Cell A10 with the first ten "dots" of the first captured frame filling cells A10-A19 inclusive.
c) The gray shading tells you that ten lines of data have been entered, corresponding with each of the ten "dots" on the captured image.
d) The alpha characters in column "B" will designate which space corresponds to the next data point.
e) Just be honest with the identifications and record what you see. Do not try to predict or skew the outcome.

Figure 3: Entry of Raw Data - James Azueta (2nd L seated) and Jeff Miller discuss the identification of a benthic feature during the data entry process. Leslie Walling Photo.

NOTES:

- Refer to the benthic group/species for the correct FOUR LETTER identification code.
- If the item under a "dot" is the aiming wand, enter "WAND".

- If the item under the "dot" is the transect tape, enter "TAPE".
- If the item under the "dot" is in a shadow, enter "SHADOW".
- If the item under the "dot" is unidentifiable due to the image resolution, enter "UNKN". Note that this differs from being unidentifiable due to a shadow, or obscured by the tape, wand or a shadow.
- If the item under the "dot" is a coral, but you can not positively determine the species of coral, enter "CORAL".
- If the item under the "dot" is a macroscopic algae, but you can not positively determine the species, enter "MACA".
- Identification codes should be in all capitalization.
- There should be no spaces before or after the identification code or name.

IMPORTANT: DO NOT DELETE A LINE. IF A MISTAKE IS MADE IN THE DATA ENTRY, JUST DELETE THE ERRANT LETTERS AND RE-ENTER INTO THAT CELL.

12. Notes may be entered for each line of data in the corresponding "C" column. For example, if a "dot" is over a sea fan, enter **GORG** in column "A" and **Fan** in column "C" of the same line.

    If a coral is bleached, enter the respective identification code in column "A", and enter **BL** (for bleached) in column "C" of the same line.

13. When you have completed the data entry for all ten (10) points for that captured image, check to see that the **DOT SHEET NUMBER** and the **TIME CODE** have been entered for the image. Record missing data as necessary

14. Remove the plastic sheet and place it in a "used" pile.

15. Observe an item in the top center of the image. Press "**play**" to start the video and watch that feature until it has traveled from the top of the screen to just off the bottom of the screen. At that point, "**pause**" the video image. This is the method for "**capturing a unique image**". (This will be done approximately 50 times per 20 meter transect.)

16. Place a plastic overlay of random "dots" from the "new" pile over the screen, orientating the alignment dots together (Step #8 above).

17. Record the **DOT SHEET NUMBER** and the **TIME CODE** (Steps #9 and #10 above).

18. Proceed with the data entry until all the captured images for the transect have been analyzed. Remember to observe a benthic feature before taking the video off "**pause**".

19. NOTE: You have several minutes to work on "**pause**" before the video is started automatically. If this happens, return to the exact frame that you recorded for that ten "dot" data series and finish the work there.

20. Once you have completed the analysis of all the captured images for the transect, go to cell B6 and CHECK that the number of data points that have been "input" (and automatically counted by the spreadsheet) as raw data equal what you have entered. This can be figured by the number of captured images multiplied by the number of random "dots". Or, you can look at the cell number for the last data entry, and subtract "9". For example, if the last data entry is in cell 509, subtract 9 to arrive at 500 data points.

21. Check with cell H6 to see that the number of points calculated equal the number of points entered. If the data was entered accurately (no misspellings or errant spaces) then the question posed in cell G6 should be answered automatically in Cell H6 as **YES**. If the answer is **NO**, then there is at least one data point that was not entered correctly (Cells A10 through the end of the data set), or the number of "dots" entered (Cell B6) is not accurate. DO NOT PROCEED UNTIL THE ANSWER TO THIS QUESTION IS **YES**. When the answer is **YES**, proceed to number 23 below.

22. If the answer is "**NO**", proceed with the following:
    Check with column "F", beginning with F10, and scroll down that column.
    - If the four letter identification code was entered correctly (no misspellings or spaces etc…) in column "A", that same code will appear in column "F".

    - When the entry in a cell in Column "F" is **#N/A**, there is a mistake for entry in the corresponding cell of Column "A".

    This will assist you in checking for entries that have mistakes. Note that blank spaces *before &/or after* entries are considered anomalies and not read by the spreadsheet. Data entries must consist of the abbreviations only, no spaces before, within, or after the letters.

    - Once you have found the mistake(s), make the change in the raw data in column "A".

IMPORTANT: DO NOT DELETE A LINE. IF A MISTKE IS MADE IN THE DATA ENTRY, JUST DELETE THE ERRANT ENTRY AND RE-ENTER INTO THAT CELL.

Check the question at line G6 to see that the answer in H6 is "**YES**". If it is not, repeat the above procedure or check to see that the correct number of data points has been entered into cell B6.

23. Once the answer in cell H6 is "YES", **SAVE** the spreadsheet. Make sure that the name is in the appropriate subdirectory corresponding to the transect location and date.

24. To begin another transect analysis, select the TAB label corresponding to the next transect for analysis.

25. Begin with the entry of the "metadata" as described in Step #6 above.

26. Continue with the data entry process, capturing unique images and recording the data under the series of random "dots" as described in Steps #8 through #23 above.

27. The raw data being entered is being automatically "linked" to the data tables on the separate TABS of this spreadsheet. NO CUTTING & PASTING IS NECESSARY.

Printing the Raw Data sheets and Result Tables

1. Select the TAB for the appropriate TRANSECT NUMBER of the Raw Data sheet that you want to print.

2. Go to the drop down menu TOOLS, PROTECTION, UNPROTECT SHEET.

3. Go to cell I9, PERCENT category and click on the down arrow. This will give you options from which to filter the analyzed data set. Select "CUSTOM", and then select for "Not Equal to" and "0". This will reveal all the species that were not equal to zero, thus all the species that were present on the transect. Select the three rows from G1 – I1 down to the bottom of the summary chart and the total values.

4. This should be printed on one page. To accomplish this:

   - Go to FILE, PRINT AREA, (arrow to the side), SELECT PRINT AREA. This sets the area to print as what you have selected.
   - Do a print preview to make sure it fits on one page (not to waste paper), then select print. You should check to see that the transect date, and label (metadata) is present on the top of this printed page.

5. Once the section has printed, return the data page to normal. **You do not want to save a modified data spreadsheet**. FILE, PRINT AREA (arrow), CLEAR PRINT AREA.

6. Now go to the "Percent" box with the drop down arrow in it. Hit the arrow and select "ALL" to get all the data back. (It is at the top of the possible selections list.) **IT IS VERY IMPORTANT THAT THIS IS DONE BEFORE SAVING THE DATA SHEET, OTHERWISE RAW DATA MAY BE MISSING!**

7. Go to the drop down menu TOOLS, PROTECTION, PROTECT SHEET. A check-mark should be in contents, objects and scenarios, then click OK.

8. To print another transect, proceed to select the appropriate TAB corresponding to the transect that you need to print and proceed to Step #2 above and begin again.

9. To print the results table, select the TAB for **PRINT TABLE**.

10. Select Print Preview to see that this information can be printed on one (1) or two (2) page(s). Ten (10) transects can fit on one page, and twenty (20) transects will need to be printed on two. The default font is Arial, 8 point and the paper is in the "landscape" orientation.

11. Select Print.

12. Go to cell A37 and A38 to record the location of this file, and the date at which any modifications were made.

13. Record in the README file, what you have done, the transects that have been analyzed and the names/locations to which the files have been saved. Then save the README file.

