

South Florida/Caribbean Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure CR01

Using Videography to Monitor Coral Reefs—Version 2.1

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Summary

This standard operating procedure (SOP) describes the preparation of video camera and underwater housing, laying tape transects and filming coral transects in the field, and post-dive activities. An annual refresher/review is recommended among staff to ensure consistency.

Revision Log

Revision Date	Author	Changes Made	Reason for Change	New Version #
2002	Jeff Miller, Caroline Rogers	Published Protocol: Miller, J. and C. Rogers. 2002. Using Videography To Monitor Coral Reefs. U.S. Geological Survey Technical Report.	Original published Videography protocol.	1.00
March 2008	Jeff Miller	Began switch to High Definition (HD) video with 1 year overlap using both previous digital video camera (DV) and HD methods (at all index sites except AM).	Old camera was reaching point it needed replacement and high definition video would offer a greater resolution to increase identification and decrease unknowns and shadows. An overlap allowed a comparison of technologies to ensure any changes were captured and accounted for analyses and interpretation.	1.01
March 2009	Jeff Miller	Ended use of Digital Video and used HD exclusively.	1 sampling of overlap at each site was completed for comparison purposes.	1.02
January 2015	Jeff Miller	SOP re-written to meet I & M program, organization, and format requirements.	Tied to I & M 2.00 version of protocol.	2.0
February 2020	Jeff Miller	SOP name changed from 1 to CR01. Equipment change to Panasonic GH4 video camera with Nauticam housing. This camera writes digital media (photos and video) to a SD card (replacing the digital tape storage medium). Additionally, the use of the Sola 3800 video lights was added.	Renamed according to regional guidance. New smaller, lighter video camera and housing to simplify travel and lights to assist with benthic identification at deeper sites.	2.1

Contents

	Page
Overview.....	4
Time Requirements	4
Materials and Equipment	4
Video Equipment Preparation and Handling	6
Prepare the video housing.	14
Put the camera in the housing.....	15
Pressurizing the Housing.....	16
Attaching the Video Lights	17
Attach the Wand Mounting Tray.....	18
Field Activities.....	19
Laying the Transect	20
Filming the Transect.....	20
The Introduction	20
The Transect	21
The Swimback.....	21
Post-Dive Tasks.....	22
Disinfection and Rinsing	22
Camera and other Sensitive Equipment	23
Printable Checklists	24
Field equipment checklist for SFCN benthic monitoring.....	24
Standard equipment:.....	24
Additional Equipment for Remote SFCN Field Stations (BUIS, SARI AND DRTO).....	24

Overview

Given the constraints of scuba diving, photography provides the most practical means of sampling large areas underwater. While still photographs offer better resolution than video images, the high-definition (HD) video technology now available is adequate for monitoring benthic cover on coral reefs, the objective of this protocol. A diver needs good buoyancy control to produce quality video images and reduce chances of damage to the bottom the diver or equipment.

In this method, the diver uses a HD video camera fitted with a wide-angle lens and an underwater housing. The diver films while swimming slowly (~30 seconds per meter [3.3 feet]) along the transect holding the camera perpendicular to the substratum from a height of 40 centimeters (15.7 inches [in]), producing a “swath” or belt transect that is about 45 centimeters (17.7 in) wide.

Back in the office (described in SOPs CR10–12), the video is viewed to make sure that the clarity and resolution are satisfactory, then saved to the server to archive the raw footage. After transfer to the computer, the video is played to “capture” and save adjacent, non-overlapping frames as still images (PNG files). In this way, each transect is depicted by several unique frames, or video “quadrats.” Random dots are placed on each frame during a process that uses an Adobe Photoshop script. After the images have been processed, an analyst identifies the benthic components under the random dots while viewing the frames in Adobe Photoshop. These data are entered into the database and can then be used to calculate percent cover of substratum categories.

Time Requirements

- Preparation of the video camera takes approximately 15 minutes and is done before going out in the field.
- Once in the field, setting up and verifying the accurate placement of the transect takes approximately 5 minutes.
- Videotaping requires about 5 minutes of bottom time per 10-meter (32.8 foot [ft]) transect, plus the time needed for transect location and set-up. Each 64GB SD media card holds at least 120 minutes of video so all 20 transects can fit on a single card.
- Removal of the transect tape after all underwater data collection is completed takes approximately 5 minutes.

Materials and Equipment

This section describes preparation of the necessary equipment, not including standard dive equipment. It is meant to augment, not replace, the manufacturer’s instructions.

- Camera and accessories (with manual)
 - Panasonic DMC-GH4 Digital Camera/Body

- Lens: Olympus M. Zuiko Digital lens
 - Focal length: 14-42 mm
 - Variable aperture: 1:3.5–5.6
 - Camera batteries (charged) and charger
 - 64GB SDXC UHS-1 flash card (95MB/s write speed) * **Note this is the minimum requirements for the card in order to have effective write speed.**
- Housing and Accessories
 - Nauticam NA-GH4 Underwater Camera Housing
 - Moisture detector/alarm battery (3volt, CR2450)
 - Distance aiming wand (70 cm total length, 40 cm extends beyond the front of the housing)
 - Wand mounting tray, with two bolts and wingnuts
 - Red screw on filter – 67mm
 - Pump (to pressurize housing)
 - Silicone grease
 - Cotton Q-tip swabs
- Sola 3800 Video lights
 - 2 Sola lights
 - 2 video light arms
 - 4 connector pieces
 - 2 light chargers
- Miscellaneous underwater equipment
 - Video slate (Magnadoodle type), with pen/pencil attached
 - 15–50 meter (15–164 ft) fiberglass survey tapes (as needed, depending on the site) on a plastic reel with metric units shown on at least one side. There should be a mark on the tape to denote the 10 meter (32.8 ft) point.
 - Clipboard with map, range/bearing, and transect relocation photos

- Optional: clipboards, mylar, pencils, rubberbands

Video Equipment Preparation and Handling

- Charge the video camera batteries prior to the day of diving. Insert the battery in the camera when charged.
- Insert a new SD card into the camera prior to monitoring.
- Set top right dial to "movie camera-M" setting (between C1 and M; Figure 1)



Figure 1. Movie setting indicator.

- Set top left dial to single rectangle (Figure 2).



Figure 2. Indicator for single image setting.

- Set small rotating lever on the back (to the right of the viewfinder) to AFC (auto focus continuous, Figure 3).



Figure 3. Auto focus continuous indicator.

- Turn Camera On
 - Press Fn3 button
 - Set AF Mode to 1-Area
 - press the AF-Area box on the camera display (touch screen)
 - scroll the back wheel 5x clockwise to enlarge the area to the maximum allowed
 - Press menu/set button in the middle of the back-scroll wheel
 - Press “set”
- Press the menu/set button in the middle of the back-scroll wheel to get the main menus. Select the top “movie camera” icon (Figure 4, yellow circle).

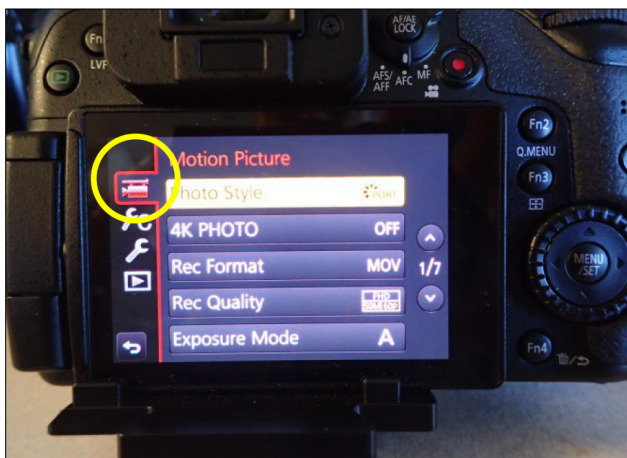


Figure 4. Movie settings icon.

The following settings will be associated with the “movie camera” icon (in the top left). Grey area means feature is has been disabled.

Table 1. Movie feature settings. ¹ Grey areas have been disabled.

Motion Picture Page #/of Total	Category	Setting
1/7	Photo style	Portrait
	4 K photo	off
	Rec format	MOV
	Red Quality	FHD 50m/60p
	Exposure Mode	A
2/7	Variable Frame Rate ¹	Off ¹
	AFS/AFF	AFF
	Picture Mode ¹	movie camera highlighted ¹
	Continuous AF	ON
	Metermode	dot in the center (.), TOP icon
3/7	Highlight shadow	STANDARD; first icon, flat diagonal line
	iDynamic	off
	iResolution	Standard
	Master pedestal	0
	Luminance Level	0-255
4/7	Synchro Scan ¹	off ¹
	Ex. Tele Conv	off
	Digital Zoom	Off
	Time Code	Off, REC RUN, (space), DF, off
	HDMI Rec Outlet	4:2:2 8 bit, off, off, off, 60p
5/7	Sound output	realtime
	Silent operation	on
	Mic level display ¹	on ¹
	Mic level adj	0db
	Special Mic. ¹	Stereo ¹
6/7	Mic level limiter	Off

Motion Picture Page #/of Total	Category	Setting
	Wind Cut ¹	Auto ¹
	Lens Noise Cut ¹	Off ¹
	SS/Gain Operator	SEC/ISO
	Anamorphic (4:3) ¹	off ¹
7/7	Color Bars	SMPTE

¹ Grey areas have been disabled.

- Press Wrench with the “C” icon - Custom, found on the upper left of the display back (Figure 5, yellow circle).



Figure 5. Custom setting indicator.

Table 2. Custom feature settings. ¹Grey areas have been disabled.

Wrench with "C" icon - Custom page #/of # pages	Category	Setting
1/9	Cust. Set Mem	[nothing]
	Silent Mode On (no lights or noises inside the housing)	On
	AF/AE Lock	AF/AE Lock
	AFL / AEL Lock Hold	on
	Shutter AF	on
2/9	Half Press Release	off
	Quick AF	off
	Eye sensor	off
	Pinpoint AF Time	mid
	AF Assist Lamp ¹	off ¹
3/9	Direct Focus Area	off
	Focus / Release Priority	release
	AF+MF	off
	MF Assist	on (lens barrel focus)
	MF Guide	off
4/9	Peaking	off
	Histogram	off
	Guideline	off
	Center Marke	off
	Highlight	off
5/9	Zebra Pattern	off
	Monochrome Live View	off
	Constant Preview	on
	Expo meter	on
	LVF Disp Style	dots on image (bottom one)
6/9	Monitor Disp Style	dots on image (bottom one)

Wrench with "C" icon - Custom page #/of # pages	Category	Setting
6/9	Monitor Info Display	on
	Rec area ¹	movie camera icon ¹
	Video Priority Display	on
	Auto Review ¹	[nothing] ¹
7/9	Fn Button Set	none set
	Q.Menu	PRESET
	Dial Set	[nothing], don't change
	Video Button	on
	Power Zoom Lens ¹	[nothing] ¹
8/9	Lens w/o focus Ring ¹	[nothing] ¹
	Eye Sensor	HIGH, LVF/MON/AUTO
	Touch Settings	On, off, off, off
	Touch Scroll	L
	Menu Guide	off
9/9	Shoot w/o lens	off

¹ Grey areas have been disabled.

- Press Wrench icon (only) – Setup, found on the left side of the display back (Figure 6, yellow circle).

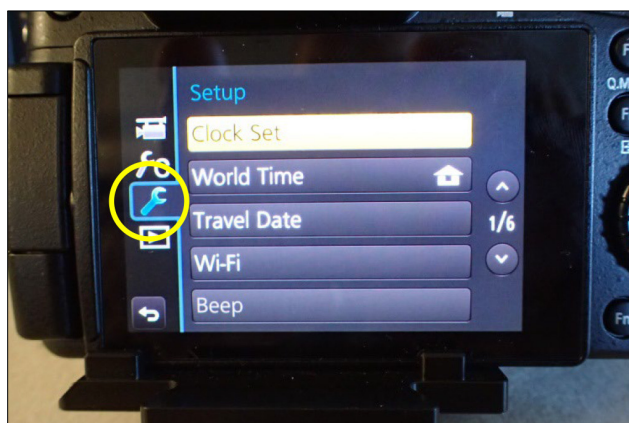


Figure 6. Wrench setting indicator.

Table 3. “Wrench” feature settings. ¹Grey areas have been disabled.

Setup page #/of #pages	Category	Setting
1/6	Clock Set	set this
	World time	home
	Travel date	off/off
	Wifi	[nothing]
	Beep ¹	[nothing] ¹
2/6	Speaker volume ¹	0 ¹
	Headphone volume	3
	Live view mode	60 fps
	Monitor display	middle everything
	Monitor luminance	A*
3/6	Economy	5 min / 5 min
	Battery use priority	BG
	USB mode	select on connection, Camera and cord icon
	TV connection	16:9, Auto, 3D, off
	Menu Resume	On
4/6	Menu background	grey (top)
	Menu information	off
	Language	your choice
	Version Disp.	2.2/1.1
	Exposure Comp. Reset	off
5/6	No. Reset	[nothing]
	Reset	[nothing]
	Reset Wifi Settings	[nothing]
	System Frequency	59.94Hz (NTSC)
	Pixel Refresh	[nothing]
6/6	Sensor Cleaning	[nothing]
	Format	[nothing]

¹ Grey areas have been disabled.

- Press green rectangle with “play” symbol (Figure 7, yellow circle) – Playback, found on the left side of the display back. The following settings are found in that menu. Grey areas have been disabled.



Figure 7. Playback setting indicator.

Table 4. Playback feature settings.

Playback page #/of #pages	Category	Setting
1/4	Slide show	[nothing]
	Playback Mode	play button
	Location logging	[nothing]
	RAW processing	[nothing]
	Clear retouch	[nothing]
2/4	Title Edit	[nothing]
	Text Stamp	[nothing]
	Video Divide	[nothing]
	Time Lapse Video	[nothing]
	Stop Motion Video	[nothing]
3/4	Resize	[nothing]
	Cropping	[nothing]
	Rotate	[nothing]
	Rotate Disp.	on
	Favorite	[nothing]
4/4	Print Set	[nothing]
	Protect	[nothing]

Playback page #/of #pages	Category	Setting
4/4	Face Rec Edit	[nothing]
	Picture Sort	Date/time
	Delete Confirmation	[nothing]

Prepare the Video Housing

- Open the back door of the housing by pressing the red tab and rotating the locking mechanism on the right side of the housing. See page 14 of the Nauticam manual for more details and pictures.
- Use your fingers or a blunt wooden object (never a sharp or pointed object) to remove the gray O-ring from the back of the housing.
- Use cotton swabs to clean the grooves of the back-housing plate and the o-ring sealing surface that is located at the very back of the camera housing.
- Apply a dab of silicone grease on your thumb and index finger and rub it onto the active-use o-rings. Use enough silicone to make the o-rings shiny, but not so much that gobs of silicone will catch debris.
- Inspect the o-rings again for any imperfections or any dirt, lint or hair that may adhere to them. The silicone is not intended to prevent water from getting past the o-ring; it just maintains the o-ring's flexibility so it can change shape in the groove, creating a barrier to the water.
- Turn the moisture detector/alarm toggle switch to ON (Figure 8). See page 12 of the Nauticam housing for more details and pictures.



Figure 8. Moisture detector alarm switch in the ON position

- Lift the outside knobs or dials that control the following knobs/dials on the camera (to allow the camera to slide into the housing unobstructed).
 - The mode dial and mode dial lock
 - The drive mode dial
- Assure the tray locking lever is “open” (to the right).

Put the Camera in the Housing

Once the camera settings are adjusted and the housing has been prepared as described above, the camera can be slid into the housing. **Note:** have a fully charged battery and proper SD card in the camera before insertion. Once the camera is in, the following three housing items need to be adjusted.

- Move the camera tray lock arm to the left to lock the camera in place (Figure 9).



Figure 9. Camera tray lock arm. Movement to the left is “lock” position, to the right is “unlock”.

- Push the mode dial and mode dial lock controller down, so they can contact the mode dial.
- Push the drive mode dial down until it contacts the drive mode dial on the camera. Contacting these controllers allows the diver to manipulate these camera knobs during the dive (Figure 10).

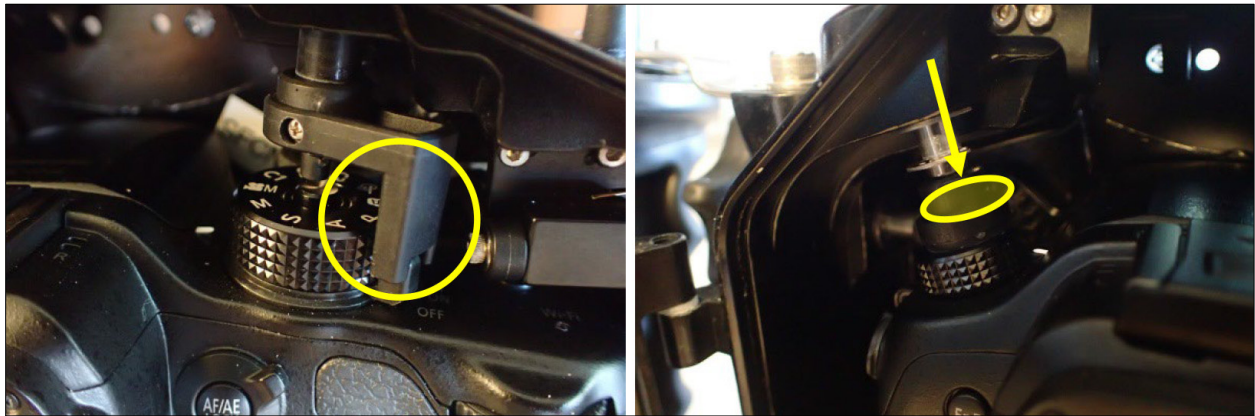


Figure 10. Camera housing control arms connecting with camera control knobs.

- Once the camera is locked in the housing and the controllers are set, close the back cover.
- See page 15–16 of the Nauticam housing for more details and pictures.

Pressurizing the Housing

This housing has a Nauticam vacuum check leak detection system. This is a valve (red button) that is screwed into the M16 port on the top of the camera. During operation and storage, this valve has a cap screwed onto it (Figure 11). After setting up the camera, a small hand pump is put on this valve and air is pumped into the housing. If the seals are all holding, the green light is displayed on the back of the housing. If there is not a good seal = air leak, a red light is displayed. NOTE: The moisture detector/water alarm toggle switch must be in the “on” position for this to work (Figure 8).



Figure 11. Cap covering vacuum port for leak detection alarm system.

To pressurize the housing (e.g., before diving)

1. After closing the back of the housing, unscrew the cap on the left top side of the housing covering the M16 port.

2. Put the hand pump over the top of the valve.
3. While holding in place, pump air into the camera housing.
4. Watch the LED display on the back of the housing to see that it turns from the blinking blue light, to a blinking yellow light (indicating that it is being pressurized) to a solid green light (indicating the appropriate pressure has been reached. This might take 10-15 pumps).
5. Once the green light is displayed, remove the pump, and screw the cap back on top of the valve on the M16 port.
6. During the dive, if the green light turns to a blinking yellow light, the housing is losing pressure (leaking) and should be brought to the surface. If the light turns red, this indicates the housing is no longer pressurized and a flood may occur.
7. Note that if the housing is depressurized and the red light is blinking, the system will have to be reset by turning the switch inside the housing from ON to OFF to ON again (Figure 8), and then re-pressurizing the housing.

To de-pressurize the housing (e.g., after diving)

1. Unscrew and remove the cap from the top of M16 port.
2. Depress the valve atop that port by pressing the red button. You should hear air hissing out. The light should go from green to blinking red.
3. Once no more air escapes, replace the cap on the port.
4. Open the back of the housing.
5. Turn off the moisture detector/water alarm toggle switch.

Note: it is important to bring the vacuum pump in the field in case the housing needs to be opened prior to a dive so that it can be re-pressurized before diving.

Attaching the Video Lights

If lights are to be used, they are connected just before attaching the wand mounting tray. Connectors are fastened over the two black knobs in such a manner that the video light arms attach to the opposite side of the connectors, then the wand mounting tray is attached as shown in the section below. The video lights are attached by connectors at the opposite end of the arms (Figure 12).



Figure 12. Arrangement of Video light arms and connectors.

Attach the Wand Mounting Tray

Once the camera is installed in the housing and the housing is pressurized, the wand mounting tray is installed on the housing. It is placed on top of the camera so that the wand mount is on the left.

1. A bolt on each side of the mount is screwed into the strobe mounts on the camera housing. A wingnut on each bolt can then be tightened to make sure the wand mounting tray is securely attached to the housing (Figure 13).

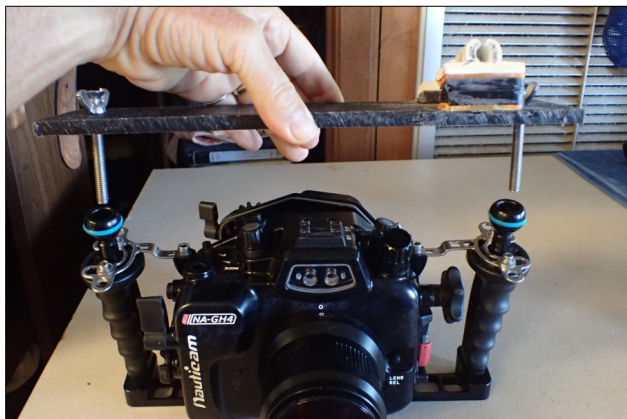


Figure 13. Mounting the aiming wand tray.

2. The wand needs a piece of tape wrapped around it, which delineates the appropriate distance from the bottom (40cm from the lens). This tape is immediately behind the wand mount that is closest to the back of the camera. Its placement here helps prevent the wand from slipping during use (Figure 14).



Figure 14. Arrangement of lights and aiming wand.

Field Activities

Laminated site maps and/or range and bearing matrices contain distance and compass bearings between transects. These are used to navigate dive teams within meters of the transect origin pin. Laminated transect relocation pages (see SOP 16 for making these) are taken underwater showing precise location of the transect relative to benthic features. After laying the first transect at the site with a survey tape, you start by filming an underwater slate that identifies the transect, then film the transect itself with the camera oriented 40 centimeters (15.7 in) from and perpendicular to the bottom. At the end of the transect, the filming continues at an oblique view as you swim back to the starting point.

Do not make a force-full entry (e.g., back-roll or giant stride entry) into the water while holding the video housing, which may force water past the o-rings. Instead, have the housing handed to you or reach into the boat to retrieve it after you are in the water.

Laying the Transect

To mark the transect, you will need a fiberglass survey tape with a string leader attached to the free end so that you can secure it to the pin. After locating the start of the transect:

Use the string to attach the free end of the tape to the pin as close as possible to the start of the transect so that you can begin filming at the 0-meter point. Take care to avoid injury to any living organisms.

Run the tape along the designated bearing for the selected transect distance, i.e., 10 meters (32.8 ft). However, you may need to extend the tape beyond this distance (note the terminal distance to the pin on the relocation photos) to the terminal pin. There may be gaps where the tape is not flat against the bottom because of bottom contours, but make sure the tape is straight and taut (not moving in the surge/current), and as close to the bottom as possible. It should not entangle, bend, or abrade gorgonians, sponges or other living creatures.

Use the laminated relocation photos to assure proper placement of the tape. Re-swim the transect to assure the tape is aligned properly. Time spent carefully laying the tape will pay off later in better video images and consistent sampling.

It is essential to identify the end point of the transect (i.e., the 10-meter (32.8 ft) point on the transect line), so that it can be easily distinguished in the video. Transect tapes should have been blackened at the 10-meter (32.8 ft) point prior to use in monitoring. If no distinguishing mark exists at the 10-meter (32.8 ft) point, tie a small piece of flagging tape (or cable tie) at that point. A large piece of flagging tape may obscure benthic components when the video is analyzed.

Filming the Transect

The filming is broken into three components: introduction, transect and swimback. Each segment produces video for a specific purpose.

The Introduction

This includes the filming of the slate and all other motion of the camera until it is positioned at the origin pin, perpendicular and 40centimeters (15.7 in) from the bottom, centered on the transect tape. This video produces the captured image of the slate from which all other captured images are referenced. In the video log, this section of video is referred to as “Intro” and is about 30 seconds in total duration.

To identify the transect, write the following information on the slate in large letters:

- date
- site name
- transect number
- if a red filter is being used (e.g., “Filter On”)

- depth
- If lights are used, how many? What power?
- F-stop of camera
- videographer and other samplers' initials

Filming legible data on the slate is vital. When the video is reviewed in the lab, the analyst must be able to determine which transect it is and the circumstances under which it was filmed.

Hold the slate in front of the camera aiming rod and film it for about five seconds. Assure the camera is recording by looking for the REC display through the camera viewplate.

You can toggle the REC switch to pause the camera or continue filming and immediately move to the beginning of the transect tape.

The Transect

This includes all filming when the camera is 40 cm and perpendicular to the substrate from the origin pin to the 10 meter (32.8 ft) mark. This video produces the captured images from which the analysis is conducted. The time code corresponding to this video is noted in the video log as “transect xx.”

Hold the camera so that the 40-centimeter (15.7 inch [in]) rod is just off the substrate and the camera is perpendicular to the bottom. It must also be oriented 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). Be careful not to tilt the camera either back-front, or side-side. Make certain that the camera is recording by checking again in the viewfinder.

Position the aiming rod on the right side of the transect tape (right side as you look down the transect tape from 0–10 meters [0–32.8 ft]) and apply gentle pressure with the rod and housing to the left. This pressure when applied to sections of the transect tape where it is not touching the bottom or benthic features, can flip the tape on the side, thereby decreasing the amount of the substrate blocked by the tape.

Move slowly along the transect. Film with the camera in the perpendicular position until you reach the 10 meter (32.8 ft) mark of the transect. At that point, stop moving the camera forward for 2–5 seconds while continuing to record. It should take about five minutes to film a 10 meter (32.8 ft) transect.

The Swimback

This includes all video from the 10-meter (32.8 ft) mark until the slate for the next transect is filmed. This primarily includes the horizontal-view (wide-angle) swim along the transect from beyond the terminal pin, past the 10-meter (32.8 ft) mark reversing the direction of the perpendicular filming to the origin pin. This video is used to capture the transect relocation images and is logged in the video log as the “Swimback” and is approximately a minute in total duration.

While every effort is made to assure the location of transects (pins, range/bearings), tropical storms and hurricanes can cause major rearrangement of benthic features. During the swimback, make every effort to include nearby and relevant massive or striking “keystone” features that may survive such disturbance events to help assure the post-storm relocation of transects.

While continuing to record, swim to and past the terminal end of the transect tape and reel while slowly moving the camera to a more horizontal view. Then turn around 180°, aiming slightly back down toward the transect. While swimming about 3–6 feet (1–2 m) from the bottom, continue filming as you return along the tape at a comfortable pace. On a 10 meter (32.8 ft) transect, this should take about one to one and a half minutes. It is often difficult to get an overall perspective of the reef from images taken 40 centimeters (15.7 in) away, and this swim back along the tape will provide a “wide-angle,” oblique view of the reef /transect. This “swimback” should include wide-angle views of both the terminal and origin pins and their orientation to key benthic features near them. This portion of the recording is useful when creating the transect relocation pictures, see SOP CR16.

When back at the beginning of the transect, swim about a meter beyond the origin pin, then toggle the REC switch to stop recording.

When all field data have been collected from the transect (e.g., disease, *Diadema* abundance, scleractinian species lists) the transect tape is removed from the bottom.

Before moving to the next transect, evaluate if the pin top needs to be scraped or cable tie on the terminal end replaced. Do not scrape the pin top if the site is in a high dive traffic area as this subjects the pin to disturbance by the public.

To prevent the transect tape from being a “vector” for potential disease pathogens, it is not laid on the bottom to mark another transect until it has been rinsed (unspooled) in a mild bleach water solution.

Divers consult the range and bearing matrix, or site map to navigate to the next transect.

Once arriving at the next transect to be sampled, change the information written on the slate as needed, repeat the steps above for laying and filming the transect.

Post-Dive Tasks

Disinfection and Rinsing

Rinse off the equipment. A small amount of chlorine bleach (about 2 ounces) is added to the rinse water tub (typically 10 gallons [37.8 liters] or more, depending upon the container). All gear can be rinsed in this solution. The transect tapes are unspooled in this rinse water then rewound in efforts to disinfect them from potential coral disease pathogens.

The handle of the fiberglass survey tape will begin to rust immediately, so wash them thoroughly after each use and spray monthly with WD-40 to prolong tape life.

Camera and other Sensitive Equipment

After the diving day is complete, submerge the entire camera housing assembly in freshwater and depress all the control buttons several times to facilitate saltwater removal. Following this rinsing, remove the wand mounting tray, and remove the video light arms. The 4 connectors for the video light assembly are removed and thoroughly rinsed, spinning the fastening handles while being rinsed in fresh water. Recharge the Sola lights after the day of use. Note: The manufacturer recommends for periods of non-use >1 month, Sola lights are to be stored fully charged. To prolong battery life, lights/batteries are cycled through two series of complete charge/discharge cycles per month. Store batteries fully charged. **When using lights but not diving, submerge the lights in a container of water to dissipate heat or damage to the light will occur.**

Depressurize the camera housing and remove the camera.

SD Card Removal and labeling:

1. Remove the SD card from the media storage location.
2. Apply a SD card label to the card being used and label with appropriate information such as park, site, observers, and date.
3. Transfer videos to appropriate location and perform video quality check to assure adequate data collection.
4. Rename video files to reflect the Year (Y), Month (M), location, and transect number (T). Use naming format: YYYYMM_SS_T##_50M60P_F##.mov. (SS=two letter site code, F=F-stop setting number used during filming).
5. If more monitoring is to be conducted (and there is adequate room on SD card), return the card to the camera body in the media storage slot.
6. If the SD card is full or if monitoring is complete, lock the SD card (Figure 14) and store the labeled card in the SD card notebook.



Figure 14. SD card showing the over-write locked and un-locked position.

Printable Checklists

Field equipment checklist for SFCN benthic monitoring

Standard equipment:

- Boat keys
- Emergency O2 Kit
- Dive cylinders - number depends upon # divers and tasks; add 2 for emergency.
- Standard personal dive equipment (mask, fins, snorkel, BCD, weights/belt, knife, exposure suit, compass).
- Save-a-dive kit: O2 analyzer, spare o-rings, zip-ties, etc.
- Boat Dive management folder containing: boat log, dive log, Navy Dive Tables, RM4, and park Dive Emergency Evacuation Plan (DEEP).
- Data management folder containing: spare datasheets (DDR and coral colony and species list etc.), site maps, relocation photos and blank underwater paper.
- Clipboards with attached pencils, rubberbands, spare pencils and 1m transect tape segments.
- HD Video camera
 - Battery in camera
 - SD Card in camera
 - Spare card and spare charged battery
- HD Video housing
 - Lenses cleaned
 - O-rings inspected and cleaned
 - Vacuum pump for camera housing leakage alarm
- Aiming wand with method for attachment to the housing
- Sola video lights
 - Batteries charged
 - Arms and connectors
- Transect tapes with metal “claw” end removed and string leader attached.
 - 30 m tapes marked at the 10 m point
 - One 50 m and/or 100 m tape
- One or two mesh bags and/or weight belt straps for carrying transect tapes.
- Sledge hammer/mallet
- Extra copper clad pins
- Point and shoot camera in housing. O-rings/groove inspected and cleaned and battery charged; SD card in camera.
- Weighted line with cave reel and float.
- Rugosity chain marked with pieces of flagging tape every 1m (if needed).
- Drinking fluids
- Sunscreen

Additional Equipment for Remote SFCN Field Stations (BUIS, SARI AND DRTO)

- Hobo base station

- Hobo boots and caps
- Hobo USB cable
- Powerstrip
- Laptop computers
- USB cable
- Box of rubber bands
- Cotton swabs
- Pens
- Sharpies
- Spool of line
- Site location floats
- Duct tape
- Electrical tape
- Kimwipes
- Toothpaste
- Silicone grease