Standard Operating Procedure (SOP) for Underwater Video Camera System

Fisheries and Oceans Canada
Pêches et Océans Canada

This Standard Operating Procedure is designed to aid in the acquisition of underwater benthic video around Newfoundland and Labrador Aquaculture Sites.

If you have further questions please contact the Aquaculture Section, Science Branch, Dept. Fisheries and Oceans Canada, North Atlantic Fisheries Center (NAFC).

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Aquaculture, Animal Health, and Biotechnology Section, Science Branch, Dept. Fisheries and Oceans Canada (DFO),
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1.0 INTRODUCTION

In response to the rapidly growing aquaculture industry on the south coast of Newfoundland, Habitat Management (HM) staff of Fisheries and Oceans Canada (DFO) needed to develop standardized monitoring in order to document any changes to benthic fish habitat as a result of these activities. From a regulatory perspective, potential impacts on benthic fish habitat and its biodiversity has typically been monitored by measuring the sulphide content of superficial sediment samples. These sulphide concentrations were then compared to a set of thresholds to determine potential impacts on fish and fish habitat and the need for any regulatory action.

It is important to note that the majority of marine finfish sites in Newfoundland occur over hard bottom substrates rather than soft bottoms so the sediment sulphide approach to benthic environmental monitoring is neither effective nor predictable. Both the sampling technique (grabs) and chemical proxies (redox and sulphide) utilized by DFO in many regions present challenges in areas having hard bottom substrates, which leads to inaccurate and unreliable assessments of benthic impacts. Therefore, underwater video of the benthic habitat was chosen as an alternate means of assessing such impacts.

In order for this methodology to be repeatable and scientifically defensible, it was essential to validate against Newfoundland specific environmental conditions, including the biological assemblages likely to be encountered. Standardizing video collection and data recording and analysis was also necessary for this approach to be successful.

1.1 Purpose:

The main purpose of this Standard Operating Procedure (SOP) is to outline the minimum requirements for collecting high quality underwater video and to standardize data recording and subsequent analysis. This SOP contains a list of the equipment needed as well as step-by-step instructions on conducting underwater video surveys. These procedures will also aid in the setup and deployment of the camera along with the actual processing and evaluation of the video footage.

2.0 SYSTEM DESIGN:

2.1 Equipment

2.1.1 Cage design

A cage is used for underwater camera systems to provide the necessary protection and stability for the equipment tethered to the surface. The cage gives the equipment a platform to rest on while on the bottom, deflects unseen obstacles from the aquaculture sites, and shields the equipment from the benthos while it is being lowered. When designing the cage, ensure the distance of the mounted camera from the bottom of the cage is high enough to capture the external grid, (a 50X50 cm grid used in the lower part of the frames field of view). This distance will maximize the field of view and still maintain an optimal focus distance. As a result of water magnification (25% > than air),

this distance should be checked and modified prior to deployment. Since green or blue colored tape shows up best in the underwater video, it should be used to cover your internal and external grids to maximize contrast, using the internal grid for size reference. Finally, to help prevent snagging or hooking on the bottom, a streamlined cage design should be used.

Cage design should follow specifications presented in Figure 1 and outlined below:

- Cage should be built out of round stock, 1/4" stainless steel material.
- The bottom exterior grid should be 50×50 cm and within the camera's field of view
- The top of the cage should contain mounts for a camera and two lights, which should be oriented towards the centre of the grid (Figure 2)
- Any bolts used should have bolt head covers to avoid snagging (Figure 3)
- The mounting for the lanyard should have a tensile strength of ~1000 lbs (the same rating as the cable), with the eye located at the top of the cage
- The cage needs to have a size reference to be used in the video frame, an internal grid of 25×25 cm located on the bottom of the frame is recommended (Figure 4)
- For size referencing lasers could also be used
- Shiny/reflective material should be kept out of the field of view, as this creates white washout in the video. Any stainless steel should be covered with green or blue tape, as this shows up best in underwater video.
- The camera needs to be orientated down for quantifying and qualifying collected video data

Figure 1: Schematic showing specifications of the camera cage design.

Figure 2: Cage light, camera and Lanyard attachment points (configuration before and after hookup)

Figure 3: Front and Side view showing the design of the cage for the underwater camera system

Figure 4: Bottom portion of the cage frame containing the 25x25cm green grid

2.1.2 Camera

The camera used for this set-up needs to have:

- A minimum resolution of 500 TV lines (Experimental camera had 550 TVL)
- A Lux value of 0.05
- A fixed focal length, as auto focus will focus on water particles not the bottom
- For additional specifications of the camera used see Appendix A

2.1.3 Deck Box

The deck box to be used in conjunction with the camera should contain the following:

- A light controller that can adjust the light intensity (Two 150watt lights; Appendix B).
- A power distribution box, which is usually included with the light control (Appendix C)
- A Global Positioning System (GPS) and GPS overlay for video
- A screen of sufficient size to allow the user to view video while recording at sea.
  - -When using larger monitors the user needs to take into account sunlight and water resistance
- A recorder, in digital format, to help speed up the processing (Appendix D)
  - -Some systems can use analog digital tapes, but since video will eventually need to be converted to digital files for submission this is not recommended

2.1.4 Power

A stable power supply, such as a generator, (minimum 1000w and compatible with electronics) is recommended as video quality will be affected by interference or power loss. An extension cord may also be needed to power the camera.

2.1.5 Cable

The cable to provide the video feed should have the following characteristics:

- Have a minimum length of 120m, however, 150m of cable will help account for scope and sounder issues encountered
- Consist of Kevlar-coated copper cable (1000lbs tensile strength)
- Contain dummy plugs
- A container for storage of cable with access hole for connecting to deck box. If the cable will be used for extended periods of time, it is recommended to store outside of the container. When storing the cable, the use of large loops is recommended to avoid kinking or twisting of the cable (min loop diameter is 20cm, loops on the deck should be much larger)

2.1.6 Spare Parts

A System should be designed in components to ensure easy and efficient switch out of broken or defective parts.

- A camera system with modular components is best so switch out of individual items can be done easily and efficiently
- Extra cameras and lights should be available in case some components fail in the field
- One redundant system available for backup (recommended but not required)

2.1.7 Winch system

It is recommended that a winch be used for deployment and retrieval of the camera cage and system. An electric winch (minimum 20cm diameter) worked well, as there is no rope needed, and the cable was used to deploy and retrieve the system. A trap hauler, with a rope, can be used as well; however, this adds an extra variable to the deployment process. The benefit is that there will be no strain on the cable, only the rope, but care is needed to keep both taunt to avoid snagging.

Operation of the winch system will require:

- A boat with working deck
- Two personnel for camera operation
- A sheltered area to keep deck equipment if the camera system is not waterproof. If you are using a waterproof system, a sheltered area is not necessary.

2.2 Additional Equipment

2.2.1 Experimental system

Enhancement and improvements to the system can be achieved through the following:

- Use of a Digital Video Recorder (DVR) instead of digital tapes, videos are in digital format, with analog audio in and out
- Use of a digital coder/decoder (e.g. the Geostamp) to overlay audio with latitude, longitude and time, (data in spreadsheet form recording date, lat, long, and time)

Note: There is a problem with this digital coder/decoder setup: to be most efficient you will need proper software developed to include, depth, species and substrate types; with the proper developed software processing time will be significantly reduced.

- GPS splitter wire to overlay coordinates on video
- A depth recorder to link depth at every station to the database. As there are discrepancies between the boat sounder and actual cage depth, due to sudden bathymetry changes, it is recommended that a logger be attached to the cage frame
- Depth loggers can be used to compensate for errors in the sounder at certain locations (ensure that the time is synchronized with the data overlay on the video)
- Additional data collected by the depth loggers, such as temperature, can help with species identification

2.2.2 Future system possibilities/upgrades

- Use of LYNN real time video enhancement
- Installation of a slip ring for cable
- Use of a zoom lens for the camera, useful for identification of some species
- Installation of lasers for size reference
- Installation of a device for measuring the deposition depth (e.g.: grid attachment)
- Attachment of additional sensors, such as a dissolved oxygen probe

3.0 OPERATION

3.1 Camera Operation

3.1.1 Experimental Setup

The following procedure should be performed for experimental set-up:

1. All components associated with water should be inspected and the cable connections greased properly using a light skim of silicone grease, just enough to cause the rubber to shine
2. Attach the lanyard to cage frame making sure there is enough slack at the camera and light connectors to prevent strain (Figure 2)
3. Attach the camera lens to the frame using cable ties. This may need slight adjustment to line up the video grid properly. The use of rubber backing will help keep the camera in position
4. Attach both lights to the frame housing, ensuring that the lights are **turned off** out of water as the plastic casing will overheat and melt. Lights should be attached totally within the frame to avoid potential snagging
5. Angle lights to hit the middle of 25×25 cm internal grid

3.1.2 Experimental deck box configuration

The deck box configuration should follow the schematic presented in Figure 5 and colors mentioned in text are specific to this figure. Set-up using the steps outlined below:

1. Attach camera/light cable to main deck box (yellow wire).
2. Attach video out from deck box to DVR (red RCA wire).
3. DVR video out connected to external monitor (blue S-video).
4. Attach GPS to both the deck box (pc connector) and GEOstamp, (Digital coder/decoder), via serial port, (if available). If no GEOstamp is being used, then only one connection to deck box is necessary (green/purple wire).
5. Ensure GPS antenna is in clear location to get satellite signals; fiberglass or thin plastic is not an issue in picking up satellite signals.
6. The Digital coder/decoder audio out should then be connected to the DVR via audio in (audio out on the GEOstamp, red RCA connector).
7. Connect power to DVR, deck box, monitor and Digital coder/decoder from 1000w generator and power bar (black wire).
8. Once everything is connected, test video and GPS overlay. The field of view should be seen on the monitor along with the GPS position (if outside). Adjustment of the lens will be needed in the frame to ensure frame alignment (external grid must be seen in the field of view and it should be relatively square). Actual position of camera on the frame must be preset to show the frame underwater, as water has a magnification of 25%.
9. Once all components are working and video overlay is seen on the screen then sampling can start.
10. Lights for the camera system can be turned on once the cage is put in the water. For best results when using 150w, the highest setting of 100% produces the best image at depth. It should be noted that light adjustment may be necessary under certain conditions (i.e. at shallower depths the image may become washed out with light reflection and a reduction in light intensity may be needed). Finally, ensure the lights are off before cage is removed from water to avoid over heating.

3.1.3 Additional Notes

The system used here is not waterproof. Newer systems can be purchased that are compact and waterproof or water resistant.

It should be noted here that video systems can be purchased to include all these components in one deck box with all wiring hidden and water resistant (the present experimental system was designed to test components). It is important to ensure the cage design, camera setup/specifications and deck box specifications meet the minimum requirements for high quality video.

The DVR setup is specific to the type of recording device used. This system required using the analog video setup in which the video would be recorded by just pressing the record button (see DVR manual for specifications). This unit worked best when recording

was started and put on pause throughout survey site. If purchasing other DVR systems it is very important to insure resolution of recording meets or exceeds the camera resolution, video quality should be due to the camera NOT the recording format.

It is a good practice to secure the cable end to the boat to avoid potential pulling of the connections and to decrease chances of cage/cable loss over the side of boat.

Figure 5: Deck box, monitor and DVR configuration (picture of actual deck box without light/ camera and generator connection)

4.0 VIDEO RECORDING

4.1 General/Typical Recording

For best results one person should operate the cable and observe the monitor. In some cases two people may be required (i.e. if the monitor is not next to the winch). In such circumstances communication protocols would have to be properly established (i.e. raising/lowering, spin left/right, etc).

Once camera is on or near the bottom and cable is perpendicular (i.e. straight down with 0^0 scope) underwater video recording should begin using the following procedure:

1. Start recording video as the bottom comes into focus.
2. The date/time(GMT)/lat/long/depth should be recorded for each drop in a field notebook.
3. Randomly place camera cage gently on the bottom at a site for ~10 sec, to insure a clear image for video analysis (see Figure 6 for sample clear image), then raise cage ~ 30 cm and drop to confirm benthic substrate type.

4. If camera is zoom capable then the zoom function should be completed after the 10 sec rule and before the drop, and the camera should return to the original position before confirmation of substrate type.
5. The number of recordings per station are subject to the resolution necessary for analysis, if more are required move cage slightly on bottom and repeat, complete the 30 cm drop for substrate type at the end of the station, not after each image because it will reduce water clarity (ensure that grids do not overlap).
6. Once water is clear, pause the video and either remove the camera (i.e bring the camera to surface), or raise it to a safe level above the bottom for travel until you reach the next station.
7. Once camera is at the next station repeat steps 1-6.

Figure 6: Camera in Position on the Bottom for ~ 10 sec. Substrate in this Picture is Bedrock

4.2 Vertical Rock Wall recording (Exception to typical recording procedure)

Sometimes video capture of the bottom at a site can be difficult due to a vertical rock face, whereby the camera cage cannot sit directly on the bottom to obtain the grid image. In such cases, a side profile of the rock surface (Figure 7) would need to be captured following the procedures outlined below:

1. Once the side of the cage comes in contact with the rock wall consider that the bottom, if there is no visible substrate below
2. The user can try to drop the cage 1-2 m more in order to obtain more coverage, but should exercise caution to prevent tangling the cage and cable
3. Treat the station the same as the above video for bottom sampling (Steps 1-6)
4. Retrieve camera, either to the surface or location above rock wall

Figure 7: Camera in Position on a Rock Wall

Note: It is easier to carry out the above sampling procedures if the boat is tethered to a cage or stationary buoy as the operator can hold position with minimal effort. Generally, all camera work is easier if the boat is fixed in a stationary position or on one plane (i.e. tied to the cage at a set distance). The operator is then only concerned with sideways motion, not front and back.

5.0 SAMPLING METHODS

This section describes the way videos should be taken at each station and how to move from station to station. Ultimately, video at each station should be completed in the same consistent manner as stated in Section 4.1.

Video sampling at a particular location can fall into two categories depending on whether there are any underwater obstructions at a site. If conducting baseline surveys and there are no known underwater obstructions such as mooring ropes and grid lines, then drift lines with the camera can be performed. *(1) Drift line* sampling permits the camera operator to raise the camera just off the bottom and move from station to station, thereby eliminating the need to bring the camera aboard the boat after each drop point. If there are cages on a site or if the site is in fallow with a lot of the underwater infrastructure still in place then (2) *Drop sampling* should be performed. This is similar to drift line sampling; however, the camera is brought to the surface after each drop before moving to the next location. It should be noted that boat operation is critical for the drop sampling procedure. If you can tether to a cage or mooring float and move out in graduated increments, the operator needs only to worry about one directional plane making it much easier to complete both drift and drop video sampling.

5.1 Drift line procedures

1. Record date, station number and site at the beginning of the drift line (in field book and white board display at beginning of video).
2. For the first station the video camera is deployed to the bottom and the video is recorded following procedures in Section 4.1 (i.e. drop the camera cage gently on the bottom at a site for ~10 sec and raise the cage approximately 30 cm and drop it to confirm the benthic type).
3. Wait until water clears before pausing video.
4. Raise the camera to a safe distance off the bottom, usually until the bottom is no longer visible and proceed with the boat to the next station (Figure 8).
5. Once at the next station and the cable has 0^0 scope (i.e. cable is perpendicular to the water) lower the camera to the bottom and start recording again, follow procedures outlined in Section 4.1

5.1.1 Advantages

- Site can be completed relatively quickly, as time spent retrieving and deploying the camera is reduced.
- No extra hauling, with minimal use of winch.
- No extra rope is required as everything is controlled from the cable.

5.1.2 Disadvantages

- Greater chance of hooking bottom or unknown obstructions.
- No individual station coding used, so stations must go by time stamp on video.
- More difficult to obtain still images as the boat may be moving too fast and the yellow cable will not be perpendicular to the water surface.

Figure 8: Drift Line Procedure for underwater video, recording only at each station (see red drops).

5.2 Drop sample Procedure

1. Record station position and site location on white board. Video camera to be deployed to the bottom and retrieved to the surface to avoid underwater obstructions such as ropes and mooring lines.
2. Attach a rope to cage, if available, to aid in camera retrieval via winch system (easier for multiple drops at a site). It is better to use the electric winch and only the yellow cable, one cable/rope to worry about (Figure 9).
3. Control of camera should be with the cable, not rope (keep rope taunt and only use to retrieve camera).
4. Camera operator should control the cage with the cable and monitor viewing screen.
5. Record as bottom comes into view, randomly drop camera cage gently on the bottom at a site for a ~10 sec and raise cage ~ 30 cm and drop to confirm benthic type (see section 4.1).
6. Wait until water clears before retrieving.
7. Return cage to surface, move to new station, mark on white board and repeat.

5.2.1 Advantages

- Stations are more organized as they are visually labeled.
- Reduces the chances of snagging on underwater obstructions.

5.2.2 Disadvantages

- Winch and extra line may be needed, which is a two man operation; one person to control winch and another to control camera and its applications.
- may move off station in the time it takes for camera to reach bottom
- More labor intensive and time consuming.

Figure 9: Drop Sample Procedure for underwater video; recording only at each station and camera retrieved each time (see red drops).

6.0 DISASSEMBLING/CLEANING SYSTEM

Once video survey is complete, the camera system needs to be cleaned, disinfected and packed away. This is especially important if you plan to visit other sites in the near future, as all equipment including ropes must be cleaned and disinfected for bio-security purposes. Iodine-based products, such as Wescodyne, are recommended as they work well around salt water. For best disinfection, equipment should be cleaned and then dried thoroughly. Once the bio-security issue has been addressed the basic steps needed for the care of your equipment are as follows:

1. Ensure connections are dry and rinse all components exposed to salt water with fresh water.
2. Take care to coil the cable in a plastic container, ensuring there are no kinks. A good rule of thumb is to turn the cable over and under, taking care not to force it, as the cable cannot be treated like rope. The use of a slip ring would solve this problem.
3. Rinse the Kevlar cable with freshwater as well.
4. The system should be stored in a clean, dry place.
5. Disconnect any stainless steel to avoid electrolysis.
6. Backup video as soon as possible.

7.0 VIDEO PROCESSING

When processing the video, follow three major steps to ensure the highest quality end product is obtained that can be easily utilized and presented to the DFO-HM staff.

7.1 Video Observation

1. Convert digital video to highest resolution format (eg. avi or equivalent).
2. Visually scan video for substrate type and any species observed.
3. “Image Capture” (freeware) can be used to analyze video and capture pictures if necessary. Refer to the help section of this software for methodology.
4. If pictures were taken, then representative substrate for the station needs to be captured usually when the camera is stopped for ~10 sec.
5. For key species that need to be quantified and are too numerous to count (e.g. Beggiatoa) the grid or laser tool should be used to determine the percent coverage in the 50x50 cm external grid).

7.2 Documentation

1. Free software such as "Image J" can help in determining the percent coverage within a specified area. However, it is important to keep in mind that a realistic resolution of the coverage is around +/-10% and "image J" will calculate to at least 1% (this requires a still image/picture). See the help section of this software for methodology.

2. Record species to lowest taxonomic level possible (e.g. class, order, family, genus, species) keeping in mind that with this type of analysis species identification may not be possible without "ground truthing" (i.e. species capture).
3. Quantify species present in the 50cm×50cm grid, (if different species fall out of the grid make note and record in the comments section of table in Appendix E).
4. Record all data on spreadsheet in the format seen in Table 1 (Appendix E1).
5. The table format (Appendix E1) will be consistent among users until the Fauna species are listed. This section of the table will vary from site to site.
6. Temperature and actual depth can be recorded with a small data logger, which can be time synchronized with the video; example of the data recorded at a site is provided in Figure 10.
7. If necessary, data can be easily grouped for additional statistics.
8. Follow the key provided with Table 1 (Appendix E2), which explains each individual column.
9. A standardized table following the same format presented here will ensure quality and consistency when processing the video.

Note: Recording can be done manually or digitally using coding software and the digital coder/decoder (this software is not fully developed as of yet).

Figure 10: Depth and Temperature Recording at One Particular Site, Both Drift video and Drop Sample can be seen (data can be exported in ASCII as well)

7.3 Final Reporting

The final report should consist of a table identical to Table 1 in Appendix E, with the above parameters as well as a statistical summary of what was found on the site and at each station. A DVD copy of the video would also accompany the report. If any species of interest were observed they would be easily found on the recording via the time stamp, therefore validation and post-processing of the data can be easily performed.

APPENDIX A: Camera Specifications

SV-16HR Colour Underwater Camera

Specifications Sheet

Rev. 2011-09-30

SV-16HR Specifications

SV-16HR Specifications	
Pickup Device:	Sony Super HAD CCD
Picture Elements:	810(H) x 508(V)
Scanning System:	2:1 Interlace
Scanning Frequency:	NTSC: 15.734 KHz(H), 59.94 Hz(V) PAL : 15.625 KHz(H), 50 Hz(V)
Resolution:	550 TVL
Angle of View:	92 degrees
Minimum Illumination:	0.05 Lux / Faceplate
Video Output:	1.0 Vp-p Composite (75 Ω)
Lens:	3.6mm fixed
Power Requirements:	DC12V (+/- 1.5VDC)
Power Consumption:	110 mA
Dimensions:	7.4cm x 3.8cm dia. (3" x 1.5" dia.)
Weight:	136 grams (.3 lbs)
Depth:	600 m (2000 ft)

*Specifications subject to change without notice.

APPENDIX B: Light Specifications

SV-Q10K Underwater Light

Specification Sheet

Rev. 2011-09-28

SV-Q10K Underwater Light Specifications:

SV-Q10K Specifications	
Length:	12.8 cm/ 5 inches
Width:	9 cm/ 3.5 inches
Height:	9 cm/ 3.5 inches
Weight:	758 g/ 26.7 oz
Depth Rated:	3000 m/ 10 000 ft
Lamp Style:	Mini Candelabra Base
Lamp Voltage:	120 or 240 Vac
Lamp Wattage:	100, 150, 250, 500 Watts
Bulb Life:	+2000 hours
	*Specifications subject to change without notice.

APPENDIX C: Power Distribution/Light Control

SV-VLC1 Video Light Console

Specifications Sheet

Rev. 2011-10-03

SV-VLC1 Specifications

SV-VLC1 Video Light Console Specifications	
Power In:	120 VAC @ 5 amp Max (optional 240 VAC)
Camera Power:	12 VDC @ 1.7 amp
Light Power:	120 VAC Full/Half power
Dimensions:	12.5"x10.1"x6.0" (315x225x150 mm)
Case:	905 Nanuk
Video Output:	Composite, 75 Ohm Unbalanced
Video Loop-through:	Yes, Video In
Operation Conditions	5-50 C (41-122 F)
Additional Options:	
Variable Light Control	Variable Control replaces light hi/lo switch
GPS Overlay	Displays location on video – GPS Included
Text Overlay	Allows text to be entered – Keyboard Included
Lynn Overlay	Adjustable enhancement of display quality
	*Specifications subject to change without notice.

APPENDIX D: Recorder (discontinued)

DN-300 DV/HDV Hard Drive Recorder

An instant on, "drag-and-drop" DV/HDV hard drive recorder. Accepts digital or analog video inputs, DV and HDV (through Firewire), component (YUV), S-Video (Y/C) and composite (CVBS) analog inputs. Every DN-300 includes a 250GB hard drive for over 19 hours of video. The Datavideo DN-300 reduce the cost of tape, with continuous recording of up to 18 hours without tape.
After recording simply connect the DN-300 to a computer based editing system via firewire and start editing immediately.

VTR-style controls with large, illuminated buttons and a two-line backlit LCD display let the user select play, rewind, fast forward, fast reverse, pause, frame advance, file selection, file delete and loop play.

Other features include seamless repeat loop play (for trade shows), variable speed forward or reverse play and frame by frame playback in forward and reverse.

Features

- Standalone DV/HDV hard drive recorder/player
- 250 GB hard disk drive – record more than 18 hours
- Records DV from either digital or analog inputs via component, composite S-Video or Firewire
- Records HDV from HDV input via FireWire
- Records direct to a native video format including HDV (.m2t) & DV (.dv) while monitoring on an Analog source
- Can record and playback up to 99 tracks
- Support DV time code
- Full VTR playback functionality, including seamless looping
- VTR-style buttons make it easy to use and navigate
- Variable-speed playback, forward and reverse
- Drag and drop file transfer to PC or Mac via FireWire
- DV video saved as .dv files, HDV video saved as .m2t files
- Converts to .AVI with the push of a button
- With the included PC CD software, you can convert to many other formats: Quicktime, AVI Type 1 and 2, Sony ES-3 Canopus AVI Type 1 and 2, Sony DSR DU-1 DV (.dvd), Matrix RT2500 DV, Avid OMF DV, .dif, .dvsd. The CD Software allows you to batch the file conversion (see below).

APPENDIX E:
Association Field Sheets
The following appendix contains the field sheets that need to be completed as part of the Standard Operating Procedure.
Appendix E1 is a template for recording field observations and video analysis (Table 1.0).
Appendix E2 is a key to Table 1.0 parameters presented in Appendix E1.

APPENDIX E1: Table 1.0 Field observations and video analysis template

Site: _____

Date:_____

General Information										Substrate									Indicators							Flora		Fauna		
Station ID	Cage # (starting)	Transect (m)	Time (GMT)	Latitude (dd.mm)	Longitude (dd.mm)	Depth (m)	Temperature (°C)	Video (Clarity 1-5)	Photo #	Primary Substrate (H/S)	Rock Wall	Bedrock	Boulder	Cobble	Gravel	Sand	Silt/mud	Flocculent	*Beggiatoa* (%)	OPC (type)	OPC (%)	Off Gassing (Y/N)	Feed (Y/N)	Shells (Y/N)	Sediment Color	Coralline Algae (%)	Kelp (%)	Species 1 (#)	Species 2 (#)	Comments

APPENDIX E2: Key for parameters presented in Table 1.0 of Appendix E1

General notes:

For total analysis view all video for that station
Analyze video and then select the photo that best represents the station ... keep video quality and camera cage position into account
Try to capture the photo for each station based on the substrate and indicators
For Fauna, analysis video record species seen in column header and build on the table as you process the video
For Flora use the 50cm by 50 cm grid for analysis to get % cover
For % cover use the grid and image J whenever possible (should correspond with the photo whenever possible)
The comments should include any relevant info or changes noted

Site:	**General location**	
Date:	**dd/mm/yyyy**	keep date in this format for consistency

TABLE COLUMN HEADER KEY

STATION ID	**X.X**		sequential order: may be recorded on white board or may have to use time stamp for drift transects (Note: the last digit would change sequentially for repeated stations)
CAGE # (starting)	**X**		gives orientation of transect line
TRANSECT	**M**		usually in meters from cage edge
TIME	**gmt(HH:MM:SS)**		always in GMT, for consistency and time sync(24hour clock)
LATITUDE	**dd.mm**		degrees, decimal minutes from photo
LONGITUDE	**dd.mm**		degrees, decimal minutes from photo
DEPTH	**M**		actual depth when camera touches bottom, may be from boat... better if from data logger
TEMPERATURE	**^{0}C**		if collected, this is the temperature at the bottom
VIDEO CLARITY	**1-5**		1 being poor and 5 being excellent, acceptable quality would be 3 (i.e video can be analysized without quality impeding it)
PHOTO	**#**		the photo and time stamp should be the same, pick photo that best represents the station substrate and indicators
SUBSTRATE	**PRIMARY**	**>50%(hard/soft)**	general characterization of bottom...majority, H for hard and S for soft
	DISCRIPTORS(+/-10%)	**ROCK WALL**	camera positioned along cliff or rock wall and grid can't cover substrate...evaluate by what is present in video frames..., but call it 100% bedrock
		BEDROCK	solid rock in picture
		BOULDER	>25.6cm
		COBBLE	6.4cm to 25cm
		GRAVEL	.02cm to 6.4cm
		SAND	.006cm to .02cm
		SILT/MUD	<.0065cm
		FLOCCULENT	Flocculent material,easily disturbed, can consist of feces and/or soft feed
INDICATORS	**Beggiatoa**	**(%)**	white mat on bottom use 50cmx50cm grid for analysis resolution to +/- 10%
	OPC	**Type**	redish worms in either a clustered colony (C) or dispersed (D) throughout the frame...
		(%)	% coverage of colony or individual worms in 50cmx50cm grid, may be able to group with Image J by color... resolution to +/-10%
	OFF GASSING	**(y/n)**	bubbles seen when cage touches the bottom
	FEED	**(y/n)**	intact feed pellets seen.. May be of various sizes according to site and size of fish
	SHELLS	**(y/n)**	mostly mussel shells that have been cleaned off the cage
KEY SPECIES	**SEDIMENT COLOR**	**Normal/black**	focus on presence of black sediment, anything else would be considered normal
	FLORA (%)	**Coraline Algae**	coralline algae, usually reddish pink covering the rocks use 50cmX50cm grid for analysis
		Kelp	wide variety of kelps, use 50cmX50cm grid for analysus, consider percent cover for all even the hold fast types.... Record what you think it is in comments
	FAUNA (#)	**Species #1**	replace Species #1 with species seen, common names are fine as long as they are identified to lowest taxa possible: record total number seen IN the grid
		Species #2	next species seen, record same as above
		Species #3	next species seen, record same as above
		Species #...etc	keep adding species according to what is seen on video (each site will differ in this area)
COMMENTS			this column is decicated to other relevant information... record species that you think are in the flora fauna section

NOTE:
Typically table with be consistant from Date to Flora for each site
Fauna will be listed according to appearance for each site, therefore will vary from site to site
KEY is to record number seen in the grid when video is stationary for set period