

# Guidelines for the use of Remote Underwater Stereo-video Cameras

**Equipment**

**Field work**

**Calibration**



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## Equipment

There is an extensive list of equipment that is required prior to commencing field work using the underwater stereo-video system. The list below will vary largely depending upon several factors:

- The number of stereo-video systems being utilised
- The number and depth of sites to be sampled during field work
- The remote stereo-video technique being employed (baited or unbaited)

All equipment should be stored in an orderly manner so that it may be located quickly by others. All video cameras, diodes, batteries and mini dv cassettes should be locked in filing cabinets in the laboratory. Storage in any location other than this and they are not covered by insurance.

There is an email booking system for the video cameras, housings, frames, sync diodes and DV recorders. In addition to this equipment, there is a sign-in/sign-out book that **must be filled out** in the computer lab when taking **any equipment**.

### *Camera equipment*

- Camera frames
  - transported without base bars attached
- Camera base bars
  - with camera housings attached securely
- Video cameras
  - with wide angle lens attached
  - matched to each housing on base bars
  - large tub(s) for transporting cameras
  - + a spare camera
- Mini DV cassettes

- 2 tapes per camera system, taped together and individually labeled + spares
- Ropes and buoys
  - specific to depths being sampled with a spare set for deepest site
- Sync diodes
  - with as many spare batteries and several spare diodes
  - securely taped to diode bars
- Camera battery chargers with power boards, camera remotes, and spare batteries for camera remotes, camera head cleaner tape, spare o-rings and silicon grease for o-ring seals.

*Hardware + other*

- Shark clips to secure closed camera housings
  - obtained from fishing shops these need to be modified in the workshop prior to use in the field
  - Require 4 per stereo-video system + spares
- Shackles (stainless steel) to attached ropes to camera frames
  - 2 per camera system
- Bolts (stainless steel) for frames and diodes
  - 4 bolts to attach each base bar to a frame and a single long, thin bolt for each diode bar + many spares.
- Duct-tape and cable ties
  - for everything! Numerous and different sized cable ties required- e.g. for closing bait bags, securing diodes etc.
- Grapple
- Toolbox
- Towels
  - for drying cameras prior to opening and for transporting cameras
- Bait baskets and bait arms

- Bait arms require a hole drilled to attach through diode arm and numerous smaller holes for bait bag attachment using cable ties
- Take numerous spare bait arms and bait baskets
- Bait
  - Use pilchards the same as commercial fisherman use, these are oilier than standard cheap mulies + gloves and container to keep bait in
- Snorkeling or SCUBA gear in the event of lost or stuck camera equipment

### *Maintenance*

The equipment you are using is expensive and fragile and it must be vigilantly cared for. There are a number of things that you can do to guarantee the equipment remains in good working order:

- When putting the video cameras in or removing them from their housings the clips diagonally opposite each other must be opened or closed at the same time. Do not open or close clips adjacent to each other at the same time because this may result in the seal not completely fastening and may make the clips more prone to opening when knocked.
- When transporting the housings make sure that they are facing upwards so not to damage or scratch their viewing surface. Plastic covers should be attached to housings to prevent their sealing surface from being damaged.
- The cameras must be transported wrapped carefully in towels within tubs. If plastic covers are not available for the housings then video cameras should be transported within the housings. However, do not leave cameras unattended within housings.
- The seal on the housings and the o-rings on the video cameras must remain clean and regularly greased with a silicon gel. Any dirt or water that remains around the o-rings seal can potentially cause damage to the o-rings or the seal of the cameras/housings.
- The camera housings should be washed in freshwater after each day of work in the field to prevent salt damage.

- The video cameras should be professionally maintained once each year. Make sure that this has occurred in the months before fieldwork. Servicing usually takes approximately 1-2 weeks at a cost of \$80 per camera. Call Camtec Electronics (see Contacts pg 13).

## **Field Work Protocol**

### *Prior to departure*

In the months prior to field work ensure you have organised boat time (assuming bad weather) and booked a car and a trailer (if needed).

In the weeks prior to commencement of field work you must ensure that all equipment is accounted for and constructed (e.g. bait and diode bars, ropes) and that you are familiar with the menu settings on the video cameras and their functioning.

If you are conducting baited surveys do not leave it to the last minute to organise your order- it is likely that suppliers wont have the amount you require in stock. 15 kg blocks of pilchards cost approx. \$45 and you will require 800 grams of pilchards for each site sampled. Stick tapes together in pairs and individually label – this takes time! Also construct recording sheets to take into the field (see Appendix 1 for an example).

Finally, all camera batteries and spares should be fully charged prior to departure and ensure cameras are switched off. Run a head cleaner tape through each video camera- this only takes a few minutes. Also, using the menu settings set each camera to the same date and time. Refer to maintenance section (pg 5) for instructions on transporting camera equipment.

### *In the field*

Take care at all times to keep the cameras dry and the housings seals from being damaged. Remember, once you have commenced your field work you cannot detach the video cameras from their mountings!! If you do you will not be able to calibrate the cameras accurately upon completion of field work and all measurements of fish length taken from images obtained from this system will suffer. Of course you will have no choice but to do this if a camera is not working.

Attach the base bars to the frames (on land if possible) and ensure bolts are not loose. It is simple if you label sync diode bars to each camera frame and use the same ones each time.

Add tapes to the cameras under cover being careful to wait for the tape to retract before shutting the camera. Ensure you record, either on the tapes or on your recording sheets which cameras correspond to each tape- this is important because if you don't know you won't know which calibration file to use when measuring fish from the images. Once you have switched the cameras on you must hit record within 3 minutes or the cameras will switch themselves off. You can use the remote to hit record with the cameras inside the housings. For the blue housings you can see through the view finder whether the cameras are recording and check settings are correct. For the silver housings you can only check whether the camera is recording by looking through the front of the housing for a small red light.

There are several settings that the cameras must be on before recording. Ensure cameras are set to wide angle, that infinity focus in on (you will see a small mountain on the bottom left of the screen) and each is set to short play (look for SP at the top of the screen). If any of these are incorrect you will need to re-do the site.

Try to only commence recording soon before deployment to maximise the amount of usable tape time. Make sure that the pin is lined up and that the camera clips are closed

properly (see maintenance section pg 5)- use two shark clips for each camera to make certain if a clip is knocked it cannot open. Attach the diode arm, insert bait arm (if applicable) and ensure sync diode is turned on. Upon deployment, lower the cameras over the side ensuring that they are in the correct horizontal position before dropping them to the sea floor. Attempt to keep the boat positioned over the drop site so not too drag the cameras off the site or pull them over. Record the GPS location of the site and the time in which you made the deployment. This will permit you to relocate them easily as soon as their filming time is complete.

To retrieve the cameras grapple the rope and pull in slack quickly. Make sure you are positioned directly above the cameras before winching them up. If you winch them on an angle you are likely to tip the cameras and bend the bait and/or damage the sync diode. Once on board, carefully dry the cameras before removing them from the housings. Check that both the left and right cameras worked before replacing the tapes with new ones.



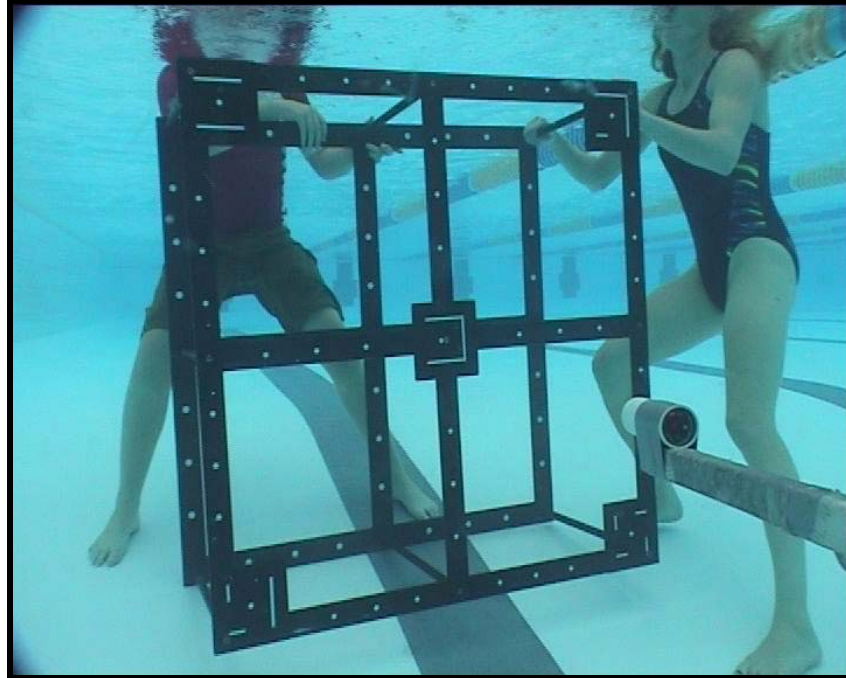
## Calibration

Calibration of the video cameras must be completed ASAP after returning from the field. Contact Rod Robinson (see page 13) to book a time to use the pool. It should not take longer than 30 minutes to complete. Take a person who has previously completed a calibration to help you.

### *In the pool*

You will require only the calibration cube, base bars with housings attached, the video cameras, a single diode and tapes (2 per system, labeled). Two people are required to complete the calibration in the pool- one to hold and rotate the base bar (this person will require goggles) and the other to rotate the calibration cube.

On the surface of the calibration cube are 93, white, 1 cm diameter dots. These dots are individually numbered with their XYZ location precisely determined as part of the calibration process. The cube is rotated 360 degrees with the cameras recording different views of the targets. The process is then repeated with the cameras flipped upright, horizontal and up-side down, upright again with the opposite camera at the top and then back in the normal position once again. The rotation of the cameras is necessary to decouple some of the parameters of the self-calibration. The cube is tilted at approximately 20 degrees so that all targets may be seen allowing for optimisations of the geometry of the network of targets and camera locations.



*In the lab*


Obtain a copy of the calibration cube sheet (Appendix 2). Grab the images from the left and right video cameras. Ensure that all tar, cal and ro pho files are in the main directory, i.e. not in folders. Begin VMS:

Obtain your tiff images

- File → project → new → name + sequence → movie sequence
- Directory: locate VMS. Target file: accept default. Calibration file: choose a cal file. Photo file: same as for cal file but ends in ro.pho. Observation file: accept default.
- Left – locate and load left video. Right – locate and load right video. Verify and continue.
- Close extra info column.
- Windows → tile vertical

- Synchronise images. Hold down small right arrow (▶) until you can see the diode light rotate. Repeat for the other video image. When in exactly the same spot → traffic light symbol. The images are now synchronised.
- You can change the increment box to move forward/backward a desired number of frames. For calibration use 2.
- Obtain the best view of all dots. When this is achieved right click on the left images and save current image as a tiff file. The name you give it will correspond to the number of the calibration sheet (see Appendix 2) (e.g. left 001 → left 020). Do the same thing for the right image. Once all 20 left and right images have been saved (a left and right from each rotation of the frame) close VMS.

#### Calibration process

- File → project → new → name + network
- Directory: locate VMS.
  - Target file = kletchframe
  - Calibration file = choose a cal file from a previous calibration.
  - Photo file = accept default
  - Observation file = accept default
  - Survey file = kletch
  - Left camera (and for right camera) – highlight and add all images (001 → 020). Verify and continue.
- Settings → image measurement parameters: change target image X and Y to 12. Change grey and min grey level to 3.
  - image point identification (brings up box)
- Automation → backdriving → all targets
- Click on the number you want from the box and on the appropriate corner of the cube. Do this for each corner and then click  ? → update and if < 5 → pass.
- Repeat and if needed manually click and correctly label other dots on the cube before updating and passing until > 40% of points appear.

- Save regularly → File → data files → photo orientation  
→ image files → save in mm
- When all 40 images are complete run a bundle adjustment.

Don't panic often the bundle adjustment fails. If this is the case:

1. View → display all images  
→ shrink to fit all images (you may have to click on and off this)
  2. Right mouse click → residual vectors
  3. Automation → resection → all images  
→ backdriving → all targets  
→ all open images
  4. Observe large error lines. You can open these images and reset numbers 2 and 3 above and update to obtain more dots or
  5. Information → image measurements → all: delete all Res y and Res x that are large (i.e. over 10). Go back and redo these images.
  6. Repeat bundle adjustment.
- Save → file → data files → camera calibration (e.g. TRV\_5\_4\_05.cal, i.e. delete .com)
  - Close VMS
  - Open 'Comp.Ro' – most likely in the same directory → browse → select photo file → process. This shows your standard deviation.
  - You can now open the text file and look at accuracy of measurements.

If you wish to obtain a picture of the calibration process or any other image from VMS you can do a screen grab by holding Ctrl and then Print Scrn. Open 'Paint' and paste.

## Contacts

If you wish to use the stereo-video system and/or associated equipment please contact Dr Euan Harvey to book (well in advance!).

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Senior Lecturer

Ray Scott 6488 2570

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Camtec Electronics 9344 2434

Camera repairs and maintenance

Unit 13, 17 Foley St Balcatta

Camera Solutions 9225 5966

Contact Peta to order mini dv cassettes

Rod Robinson 6488 2372

Human Movement School Manager

To book Human Movement pool for calibrations

Australian Commercial Marine 9431 6000

Corner Mews Rd & Capo D"Orlando Drive

Fremantle Fishing Boat Harbour

Marine Supplies

## Appendix 1

An example of a recording sheet that may be devised for use in the field.

Island Group	Treatment	Habitat/Depth	Label	Date	Cameras	Time in
Easter	MPA	Shallow: Leeward reef slope (6-10 m)	ERS1			
			ERS2			
			ERS3			
			ERS4			
			ERS5			
		Deepwater (25–30 m)	ERD1			
			ERD2			
			ERD3			
			ERD4			
			ERD5			
	Fished Location a	Shallow: Leeward reef slope (6-10 m)	EFS1a			
			EFS2a			
			EFS3a			
			EFS4a			
			EFS5a			
Deepwater (25–30 m)		EFD1a				
		EFD2a				
		EFD3a				
		EFD4a				
		EFD5a				

# Appendix II Calibration cube

