Baited Remote Underwater Video Systems (BRUVS): Application and data management for the South Australian marine parks program

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Acknowledgements

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Summary

Baited Remote Underwater Video System(s) (BRUVS) have been adopted as one of the main sampling methods to assess the long term effectiveness of South Australia's marine park network. Data collected by BRUVS will be used to answer key evaluation questions outlined in the MER plan associated with reef, seagrass and sand habitats. These habitats have been identified as key ecological values where change is predicted to occur with marine park implementation. This report describes the approach taken to monitoring, deployment of BRUVS in the field and documents the analysis, curation and storage of data collected into the DEWNR's corporate database system.

A BRUVS system works by using a bait to attract fish and capturing them on video for later analysis. BRUVS use is non-destructive and provides an efficient and repeatable method to record the abundance, size and population structure of fishes and other animals across a range of depths, conditions and habitat types.

The ecological component of DEWNR's monitoring, evaluation and reporting (MER) program focusses on priority marine parks sanctuary zones (where most change due to marine park implementation is likely) in comparison to suitable control sites outside the sanctuary zones. The monitoring design has taken a Before-After-Control-Impact (BACI) or After Control-Impact (where no "Before" data is available) approach. BRUVS are used to compliment other monitoring approaches (such as diver underwater visual census surveys) with some sanctuary zones being sampled annually and others less frequently.

Sampling is conducted primarily during the warmer months of November to May when water temperatures are higher and daylight hours are longer. As much as possible, individual sites are resurveyed at the same time of year to reduce seasonal biases. Where possible, zones and sites are selected in such a way that broader spatial patterns (e.g. spatial and physical gradients) can be considered in comparisons of multiple in and out sample sets.

A variety of data types are generated during the collection, processing and storage of BRUVS data. These include field data, video footage, reference images, data processing files, the final "point of truth" dataset and derived products (e.g. spatial layers, reporting outputs and documents). Standard procedures and protocols are used in the collection and curation of this data at all stages of the process to ensure that data collection and processing is consistent across the marine parks program now and into the future.

Corporate storage of the authoritative BRUVS dataset for the marine parks monitoring program is in the Biological Databases of South Australia (BDBSA). Data from field work and the processing of video footage is validated and manipulated into a format that is readily uploaded and stored in BDBSA. From this corporate storage point the data is available through DEWNR's "Fauna Supertable", Atlas of Living Australia, spatial layers, and internally through a purpose built database that links directly to BDBSA to produce data in a format for analysis and other purposes.

Classification and licencing of BRUVS data and products is "Open" by default in line with the Government of South Australia's Open Data declaration. Relevant datasets therefore are classified and licenced according to the DEWNR classification guidelines to establish their confidentiality, integrity and availability. The bulk of the data generated through the collection and processing stages leading to storage and production of outputs for the BRUVS sampling program, is considered 'transitionary' in nature i.e. stages leading to the production of final, distributable products, and as such, are considered as 'not ready for public distribution'. This data is therefore classified "For Official Use Only" and archived.

The corporately stored final dataset and subsequent standard data outputs are considered to be "Open" data and have been classified as "Public". Non-standard outputs such as data used in analysis for reporting are again considered 'transitional' and are classified accordingly (i.e. "For Official Use Only") with the outcomes of such analysis generally being made available through reports which themselves go through classification and licencing as part of the standard publication procedure. Licencing of the data and products classified "Public" will be applied based on the DEWNR licencing guidelines and a Creative Commons Attribution licence (CC BY) should be applied where possible.

To ensure transparency and provide guidance for individuals seeking knowledge about information collected under the BRUVS program, appropriate documentation and metadata records are produced for all relevant data. This report and its appendices fulfill that role at the broadest level, forming a summary guide to the methodology, data management and data storage. Other metadata mainly relates to the 'Storage' and 'Output' stages of the BRUVS data production process. Project metadata for the BRUVS dataset is listed under the project registration details for BDBSA (BDBSA Metadata Project 1033) while metadata relating to the collection phase (i.e. data field information from field collection and video processing) are included in the appendix of this report. Metadata relating to specific fields extracted from BDBSA for analysis and reporting purposes are available in the SA Government's "Location Metadata System" (LMS: Dataset no. 1867).

1 Scope

Subtidal reefs, seagrass meadows and soft sediment were identified in the Marine Park Baseline Reports as key ecological values likely to change with the implementation of marine parks (available on Enviro Data SA under "Technical Report"). Baited Remote Underwater Video System(s) (BRUVS) are one of the main ecological sampling methods being employed to monitor these systems and in turn help assess the long term effectiveness of South Australia's marine park network. The data collected by BRUVS will be used to help answer Key Evaluation Questions: EQ1, EQ2 and EQ3 as identified in the South Australian Marine Parks Monitoring, Evaluation and Reporting Plan (MER Plan, Bryars et al. 2017).

The aim of this report is to describe the BRUVS sampling approach and design, and to comprehensively document the process of BRUVS data capture, processing and storage in the Department of Environment, Water and Natural Resources (DEWNR) corporate database, the Biological Databases of South Australia (BDBSA). This document will describe the equipment associated with BRUVS and how it is deployed in the field, as well as the following data management procedures:

- Sampling approach and design

- Data capture, pre-processing, post processing

- Data validation, curation and upload into BDBSA

- Standard data outputs

- Data classification and licensing.

The purpose of the information contained in this document is to:

1. Demonstrate how the ecological monitoring outlined in the SA Marine Parks MER plan (Bryars et al. 2017) is being implemented

2. Ensure that standard procedures are followed when deploying BRUVS and classifying the information so that data collection and processing is consistent across the Marine Parks program now and into the future

3. Document the appropriate storage and access to the data under the government's Open Data policy

4. Provide a data platform upon which ecological reporting outputs for the Marine Parks Performance Program will be based.

It is anticipated that this will be a 'live' document (managed in iShare) in which future changes to sampling methods, data capture and technological advances can be incorporated as they arise.

2 BRUVS overview

In a review of potential monitoring methods for the South Australian marine parks program, Bryars (2013) recommended the use of BRUVS along with Underwater Visual Census as techniques for long term monitoring. In light of this recommendation, BRUVS has been adopted as a core monitoring method to collect biological data that can be used to assess the long term effectiveness of the state's marine park network.

BRUVS work by using a bait to attract fish, capturing those fish on video, and later analysing the captured footage to describe the fish assemblages that were seen (Cappo et al. 2003). BRUVS provide a non-destructive, relatively cheap and repeatable method to record the abundance, size and population structure of fishes and other animals. BRUVS can be deployed at a range of depths and are able to capture information on commercially important species or 'diver shy' species (Harvey et al. 2000a, b; Colton and Swearer 2010; Willis and Babcock. 2000). Because of these attributes, BRUVS have been increasingly used for monitoring of marine parks worldwide (Westera et al. 2003; Willis et al. 2003; Denny et al. 2004; Cappo et al. 2007; Malcolm et al. 2007; Watson et al. 2007; Kleczkowski et al. 2008; McLean et al. 2010).

A BRUVS unit consists of a waterproofed video camera mounted to a frame with a bait bag at the front to attract fish into the view of the camera. The unit is deployed into the water from a boat and is left on the seabed to record for a predetermined time before being retrieved. The video footage is then analysed to determine relative abundance (MaxN) and fish length (when using stereo units) using specialised software (EventMeasure by SeaGIS; http://www.seagis.com.au/event.html). There are many configurations in use that vary in complexity, and each system has different capabilities, depending on the questions being asked.

The most common types of BRUVS have one (single) or two (stereo) cameras mounted to the frame on a horizontal plane with the bait bag suspended in view of the camera/s (Figure 1). A rope and buoy system connects the BRUVS to the sea surface and is used in the retrieval process. Both BRUVS types are capable of detecting species richness, taxonomic diversity and frequency of occurrence. Basic environmental parameters such as habitat, depth, water temperature, water clarity and time of day are also recorded. Stereo BRUVS are capable of very accurate and precise length measurements providing good quality cameras are used, a successful calibration has been achieved and the operator is well versed in the use of the measurement software. Detailed specifications for the BRUV systems used by DEWNR appears below in Appendix 5.1.
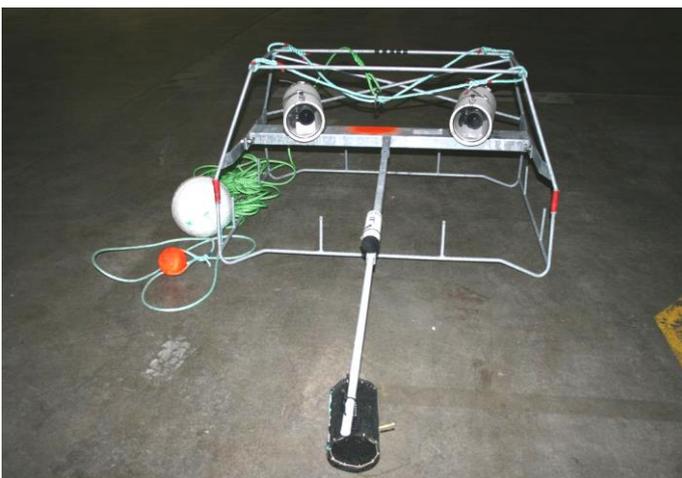
Figure 1: A stereo BRUVS unit as used in SA's marine park monitoring program

3 BRUVS field application

3.1 Location of BRUVS monitoring

In October 2014 the marine park zoning was finalized and the parks became operational resulting in the establishment of 19 marine parks and 83 sanctuary zones. As outlined in the MER plan, most changes are likely to be as a result of the implementation of SZs (Bailey et al. 2013) and therefore SZ's will be the main focus of the ecological monitoring program. Under the current resourcing levels it is not feasible to undertake monitoring in all 83 SZ (nor is it necessary). To identify where to allocate ecological monitoring effort a process was undertaken to prioritize the SZ based on their ecological value, socio-economic importance and predicted change (MER Plan). 25 Priority Sanctuary Zones were identified for monitoring (Bryars et al 2017).

3.2 Sampling approach

The design of the ecological monitoring program to answer the relevant Key Evaluation Questions has taken a Before-After-Control-Impact or After-Control-Impact (where no "Before" data is available) approach, where 'impacts' are the SZ and 'controls' are sites outside SZ's. In the case of BRUVS monitoring there is very little 'Before' BRUVS data so monitoring will predominately be of the Control-Impact design. BRUVS may be the only form of monitoring in an area or can complement other monitoring such as diver underwater visual census surveys.

At individual priority marine park SZs, where there is enough suitable target habitat, three sites are surveyed inside and three outside the zone, with four replicate BRUVS samples at each site (Figure 2). Based on the best available information and practical constraints related to zone size and available habitat, sites are separated by a minimum distance of 1 km, while replicates within sites are separated by a minimum of 200 m to achieve a level of independence while maintaining replication within available habitats. Where possible, zones and sites are selected in such a way that broader patterns (e.g. spatial and physical gradients) can be considered in comparisons of multiple in and out sample sets. Standardisation of habitat types, depths and oceanographic conditions is also sought to minimise background variability between sites.

BRUVS are capable of sampling across a range of depths, however for the purposes of the MER Program habitats are generally sampled in depths of 10–30 m. However, in some cases, bathymetric constraints, limited habitat coverage or where targeted sampling is required, sampling may be outside these guidelines.
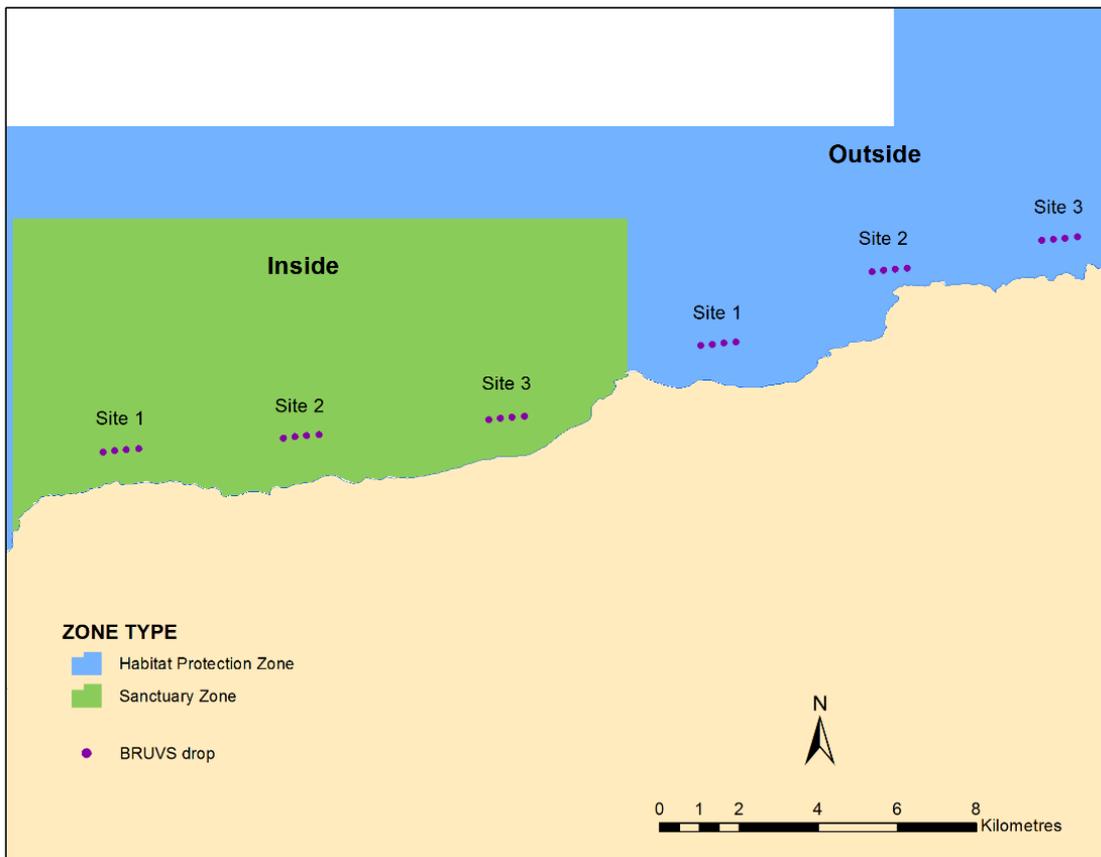
Figure 2: Example showing a typical BRUVS deployment and the relationship between sites and drops and inside vs outside of the sanctuary zone

3.3 Frequency of monitoring

Annual monitoring would be desirable at all sites at least until natural variation and likely magnitude of predicted changes are better understood, however logistics and resourcing make this not feasible. Instead a hybrid system has been adopted combining annual monitoring in some areas and less frequent monitoring at others.

There are eight marine bioregions in SA, with the highest number of priority SZs occurring in the Gulf St Vincent Bioregion. Annual surveys will be conducted at priority SZ in the GSV Bioregion because:

1. The number of priority SZ and their distribution in this bioregion provide an opportunity to assess marine park effectiveness at different scales (SZ, marine park and bioregion) as recommended in the MER plan.

2. Compliance effort is highest in this bioregion

3. The GSV bioregion is the most tractable bioregion for field work.

It is planned to survey the remaining priority SZ every four years as part of a rolling program according to Table 1. Sampling is conducted primarily during the warmer months of December to May when water temperatures are higher and daylight hours are longer. As much as possible, individual sites are resurveyed at the same time of year to reduce seasonal biases.

Table 1: Proposed location and frequency of sampling. Note that not all SZs will be surveyed annually in GSV. Large 'X's denote full surveys and small 'p's denote partial surveys.

Year	Gulf St Vincent	Nth + Spencer Gulf	Coorong + Otway	Eucla + Murat + Eyre
14/15				X
15/16	X			
16/17	p	X	X	
17/18	p			X
18/19	X			
19/20	p	X	X	
20/21	X			X
21/22	p			
22/23	p	X	X	

3.4 Technical specifications and field deployment

Two types of stereo BRUVS are used in the MER program (see Appendix 5.1 for details, including camera specifications). Cameras are set to record in high definition (1920 x 1080 pixel resolution) at a frame rate of 50 frames/sec. Prior to field deployment, each pair of cameras is calibrated in a pool using a SeaGIS 3D calibration cube. "Cal" software (SeaGIS) is used to generate calibration files (containing information about the physical parameters of each camera) which are used in analysis to generate accurate length measurements (Shortis 2015; Shortis et al. 2007; Shortis and Harvey 1998).

Each unit is deployed with a synchronisation diode (to aid synchronisation of paired video images needed to produce accurate length measurements) and a plastic mesh bait bag (250 mm x 200 mm) on the end of a 1.5 m length of PVC conduit secured within view of the cameras. Each bait bag contains ~600 grams of ground pilchards (*Sardinops* spp.) which has been ground through a 12 mm die to maximise the dispersion of the bait plume to attract fish into the view of the cameras (Hardinge et al. 2013; Bernard and Gotz 2012). Bottom water temperature is recorded by attaching an [Onset HOBO Pendant temperature logger](#) to at least one BRUVS at each site.

BRUVS are deployed at each site for a minimum bottom time of 60 minutes (Harasti et al. 2015, Gladstone et al. 2012). Species accumulation curves conducted on past DEWNR datasets suggest this to be the optimum bottom time necessary to record the majority of fish species. Each BRUVS unit has an 8 mm floating rope with a surface buoy to facilitate retrieval. Steel ballast bars are attached to the base of the frame to maintain a level descent and landing. When necessary, more weight is added to keep the unit stationary on the seafloor in the event of strong currents.

4 Data processing and management

4.1 Overview

This section documents how the program manages data and information from the UVC program as a strategic asset of the Department, according to corporate standards and protocols, and in accordance with the Managing Environmental Knowledge (MEK) Procedure, and the DEWNR Information Management Framework (IMF).

The proper management of information is essential to ensuring that DEWNR effectively and efficiently meets a number of legislative requirements such as those under the *State Records Act 1997* and *Freedom of Information Act 1991*, as well as the Information Privacy Principles. The IMF defines the overarching rationale, principles and lifecycle for the way DEWNR will manage the information it needs to achieve corporate goals and meet policy and legislative requirements which include the SAs' Declaration of Open Data in 2013 and 'digital by default' declaration. A suite of tools and guidelines in the MEK support achieving these goals for data collected in programs and projects.

The Marine Parks Program is committed to evidence based science and as such information collection by the program needs to be managed consistently in line with DEWNRs data management policies. It also needs to ensure that data and information collected as part of this program are available, accessible and well documented. The program uses MEK resources to meet these requirements.

This section also provides a detailed outline of movement of data and its management throughout the BRUVS sampling program. Data in this program moves from the 'collection' stage through processing and preparation for storage (Figure 3). Data in the collection and processing stages can be considered 'Working data'. Subsequently a number of 'Evaluated outputs' are produced including tables for upload to BDBSA, a stored 'point of truth' dataset and analysis outputs. Data from the 'Outputs' stage give rise to a variety of data and reporting 'Products'. The flow of data, data classification, data licencing and metadata requirements through these stages of the program is summarised in Figure 3. The following sections provide detailed information about the management of data within each stage of the BRUVS monitoring program. Sections 4.2–4.4 cover the 'Working data' phase and Sections 4.5–4.6 cover 'Outputs' and 'Delivery' phases. Licencing and classification of data and products is covered in Section 4.7.

4.2 Pre-field trip planning and preparation

Prior to a field survey, pre-trip data is generated which includes:

- Survey waypoints – These points approximate sample/drop locations selected during desktop planning and are updated (to "<u>actual</u>" sample locations) on field data sheets after each BRUVS unit is deployed in the field.

- Survey codes (OpCodes) – These codes represent each individual BRUVS survey sample/video. Each code is a unique ID (Primary Key) used to link different parts of the dataset (field data, abundance data, length measurements) and is integral to the data management process (see Appendix 5.2 for detailed OpCode description).

This data is provided to the field team electronically (waypoints loaded to GPS device), on field log sheets and maps to which additional information is recorded during field surveys.

4.3 Field data capture

Field record sheets are maintained throughout the survey as a record of field data associated with each survey point (OpCode). This includes:

- Updated sample locations – Waypoint number and associated latitude, and longitude from vessel or handheld GPS unit (decimal degrees, WGS84); waypoint is recorded as close as possible to a point above the BRUVS unit (accuracy estimated between 5 and 25 m due to the accuracy of the GPS unit and variability in the distance between the hand held GPS device on the surface and the BRUV unit on the seafloor)

- BRUVS unit deployment and retrieval times

- Camera and memory card numbers

- Depth from the vessel sounder

- General notes (weather conditions etc.).

Video files are recorded on memory cards. There are two sets of files for stereo camera systems (left & right), and one set for mono BRUVS (per sample location). These files are copied and backed up on portable hard drives at the end of each survey day.

Water temperature (bottom temperature) is recorded using Onset Hobo Pendant temperature loggers (+/- 0.5 degrees Celsius accuracy). The loggers are set to run at the start of each day and the data is downloaded and saved at the end of each day.

WORKING DATA   **EVALUATED OUTPUTS**   **AUTHORISED PRODUCTS**

1: Field Information Tables

Prepare
BDBSA Data Preparation tool
- Compiles export tables
- Produces 3 .csv files (Site, Visit, Species) for upload to BDBSA

Classified: FOUO

Capture
Field Survey

3: Event Measure Export Tables

Classified: FOUO
Evaluated by: Biol. Survey Team

2: Field Video

Process
Specialised Software (Event Measure)
- Text data files
- MaxN (abundance) data
- Length data

4: BDBSA Upload Tables

Evaluated by: Biological Survey Team, Biodata Support Team
Approved by: Sub team leader; Biol. Survey

5: BDBSA

Project# 1033

6: EGIS
- Fauna.Supertable LMS#5116
- BRUVS sites LMS# 1867

9: Analysis Database (direct link to BDBSA data tables)

Evaluated by: Biological Survey Team, Biodata Support Team
Approved by: Sub team leader; Biol. Survey

Delivery
Standard DEWNR Outputs
- Spatial layers
- Standard reporting

Analysis
Non standard exploration and analysis outputs

7: Fauna.Supertable

Classified: PUBLIC
Licence: CC By
Authorised by: Executive Director Science
Publish via: NatureMaps and ALA

8: Standard Outputs
(e.g. Report Cards, Species Richness table, etc.)

Classified: PUBLIC
Licence: CC By
Authorised by: TBA
Publish via: TBA

10: Technical Reports

Classified: PUBLIC
Licence: CC By
Authorised by: TBA
Publish via: TBA

11: Authorised Video

Classified: PUBLIC
Licence: CC By
Authorised by: TBA
Publish via: TBA

Archive
Data Archiving/Backup
- Raw video files
- Processing jpegs
- Software data outputs

Figure 3: Dataflow, data classification and data licencing within DEWNR's BRUVS monitoring program.
Blue icons indicate working or draft data, maroon icons indicate outputs that have been evaluated (QA) and approved, and gold icons represent authorised products ready for publishing. At each stage where data is produced, a classification is assigned and where appropriate, data is licenced and metadata records produced. Note, 'authorised products' are currently under development and the products illustrated currently represent potential products.

4.4 Data processing

4.4.1 Field data

Information from field record sheets is transferred to electronic format in Microsoft (MS) Excel along with waypoints downloaded from the field survey GPS. This information is formatted as per an Excel spreadsheet template for upload to BDBSA via a purpose designed MS Access data preparation tool. The Excel spreadsheet (Item 1 in Figure 3) contains field information for each video sample (See Appendix 5.2 for detailed descriptions and parameters for each field).

4.4.2 Video processing

After field work is completed, video files are converted to a format more appropriate for video processing and storage. The cameras split each video file into smaller files which are batch concatenated, renamed and converted to Xvid format using Xilisoft Video Converter software. A high bit rate (20,000 kbps) is used to ensure minimal loss of the video quality during the conversion.

Videos (Item 2 in Figure 3) are analysed by a trained observer using specialist software (SeaGIS EventMeasure (Stereo); http://www.seagis.com.au/event.html) to generate MaxN and length measurements for all fish and invertebrate species viewed during the 60 minutes of video. MaxN is widely used in the BRUVS community as a measure of relative abundance and is defined as the maximum number of individuals of a species seen in a single video frame (Cappo et al. 2003, Harvey et al. 2007). Counting the maximum number of individuals seen in any single frame is a method that provides an estimate of relative abundance while avoiding repeat counts of the same individuals moving in and out of view throughout the video. Where stereo cameras are used, only the image from one camera (usually left) is used for species identification and MaxN counts.

MaxN and length measurements are recorded up to a range of 4 m from the cameras (calculated by the software). This distance standardises the field of view for each BRUVS, and reduces the confounding influence of the variability associated with water clarity. In addition, precision of length measurements decrease significantly beyond 4 m. See "BRUVS video interrogation manual using SeaGIS EventMeasure" in Appendix 5.3 for a detailed 'step by step' description of this process.

Text output files from EventMeasure are collated and validated in MS Excel format (Item 3 in Figure 3) as per a template designed for upload to BDBSA through a purpose designed MS Access data preparation tool (see Appendix 5.4).

4.5 Post processing, data management and storage

4.5.1 Data preparation and upload to the Biological Databases of SA (BDBSA)

Following processing of videos to extract abundance (MaxN) and length data, these data along with field data (field record sheet information and waypoints) are saved to one Excel workbook consisting of three worksheets that is directly imported into a data preparation 'tool' (Access) for upload to BDBSA (Item 4 in Figure 3). This tool is a relational database that links to the data which has been collated and stored in the MS Excel template. This database contains queries designed to validate the data, then produce data files in a format that matches the upload template for BDBSA. For details of the preparation and upload of data to BDBSA, see Appendix 5.4 "BRUVS data preparation for BDBSA".

4.5.2 Data storage, archiving and maintenance

MER program BRUVS data is stored in BDBSA under Project 1033 (Item 5 in Figure 3), and is the 'point of truth' for this dataset (i.e. it is the primary storage point for the data and represents the authoritative or most accurate and up to date dataset to which all other versions refer). Additional BRUVS data, mostly pre-dating the MER program, is stored in BDBSA under a separate project (909), however, only Project 1033 is relevant to the scope of this document.

Data stored in BDBSA is maintained corporately and unless registered as environmentally sensitive, has a core set of elements (such as site locations, dates, species lists and counts) openly available through the Fauna Supertable, NatureMaps, Atlas of Living Australia and other spatial layers. For information on BDBSA and associated products see the BDBSA web page.

From collection through to upload into BDBSA, a record is kept of all BRUVS data under DEWNR's control (currently available within DEWNR on the iShare intranet system). An archive of all data for various stages of processing (including the individual upload files) is also stored in the same location. Due to their size, video files, reference images and software data outputs are archived on duplicate portable hard drives which are catalogued and stored in separate locations. Archived data are documented and catalogued in a spreadsheet on iShare (Archive catalogue) including information regarding storage drives and storage locations.

4.6 Outputs and access

The BRUVS data collection program produces data in the following stages:

- Collection and processing – This stage generates video files, reference images, a series of processing files (temporary files for each site, many specific to the processing software) and upload files for BDBSA. These represent data from intermediate steps leading to the production of the final dataset (i.e. the videos collected in the field and subsequent files described in Appendices 3 and 4) and are archived on a per site/location package. These data are unlikely to be accessed again unless there is an issue whose resolution requires reference to intermediate steps in the production of final products.

- Storage – This is the resultant data set consisting of fish abundance (MaxN), length and site information. The 'point of truth' storage of this dataset is within BDBSA.

- Data for analysis and reporting purposes – These data are reproduced from BDBSA in a format suited to analysis and reporting needs.

Outputs for the program largely fall into, or relate to the last of these categories (the exception being archived data from the collection and processing phase) and include:

1. Data to support the MER program (analysis and reporting)

2. Spatial layers

3. Metadata

4. Archived data.

4.6.1 Data to support MER program analysis and reporting

Data stored within BDBSA is available for analysis and reporting in two ways:

- Via a BDBSA BRUVS "data extract" produced by a custom relational database (MS Access) which links directly to BDBSA (the "SU_SUPATCH", "SU_SUVISIT" and "SU_SUSPECIES" tables). This database tool extracts data for the MER BRUVS program (Project 1033) to produce three tables (containing Site information, MaxN and

Length data). These tables are exported for analysis in a standard format on a three monthly basis. For full details on the use of the extraction database and its use see Appendix 5.5.

- Through a set of standardised reporting tools. It is envisaged that other reporting tools (UNIX or forms within Access database) will be developed over the coming year. These may include metrics such as species presence, richness and biomass by sanctuary zone and region (inside and outside of protected areas).

4.6.2   Spatial layers

The following spatial layers are outputs from the BRUVS process:

- BRUVS sampling locations layer – to be available to DEWNR staff via internal mapping tools (EnvMaps and desktop ESRI ArcGIS) as well as publically via NatureMaps

- FAUNA:supertable (Project 1033) – to be available to DEWNR staff via internal mapping tools as well as publically via NatureMaps and Atlas of Living Australia.

4.6.3   Metadata

Formal metadata records for BRUVS data mainly relate to the 'Outputs' and 'Products' stages of the BRUVS dataflow (Figure 3). Some metadata relating to the 'working data' phase (i.e. data field information from field collection and video processing) are included in Appendix 5.2 of this report. Project metadata for the BRUVS dataset is listed under the project registration details for BDBSA (BDBSA Metadata Project 1033) while metadata relating to specific fields extracted from BDBSA for analysis (which closely relate to the original working data) and reporting purposes (Item 9 in Figure 3) are available in the SA Government's *Location Metadata System* (LMS; Dataset 1867).

4.6.4   Archived video and data

Currently archived data includes a copy of the original video footage, field sheets, processing and other intermediate (upload) data files. These data are stored solely for reference in the rare case of there being issues in the final dataset that may necessitate reference back to the data from processing and upload stages. Currently these data are only available via special request to the Data Manager via DEWNRBioDataSupport@sa.gov.au.

4.7   Data classification and licencing

In 2013, the Government of South Australia committed to making government data "open" by default, i.e., proactively releasing government data to community, research and business organisations (Declaration of Open Data). This requires that data be freely available (published online where possible) and openly licensed. Production and distribution of data in this way necessitates the classification and licencing of relevant sets of data. DEWNR's procedure for classifying, licensing and releasing data are based on the SA government's Information Security Management Framework.

Data and information collected by DEWNR is considered a valuable asset and as such, should be classified and labelled according to the DEWNR classification guidelines. Classification establishes the confidentiality, integrity and availability of each set of data or information. Data or information that is to be made available publicly (e.g. on a web site, in a report, or on request) needs to be licenced according to the DEWNR licencing guidelines.

BRUVS 'working data' (Items 1–3 in Figure 3) are all 'transitional' in nature, i.e. they are collection and data preparation stages leading to the stored and reporting versions of the dataset. Although retained for reference, these data are not intended for distribution and therefore can be considered as 'not ready for public distribution or posting. These data, including original video footage are therefore classified "For Official Use Only" and archived. Future consideration will be required in some cases (in particular, video footage) as the program expands and the team seek to further expand what can be made available.

Using the same criteria, BRUVS data stored within BDBSA (Item 5; Figure 3) and the subsequent standard data outputs (Items 7–8; Figure 3) are considered open data and therefore classified "Public". In most cases data will be publically available once it has been uploaded. In exceptional cases where it is deemed necessary to delay release or where partial data restriction is necessary (e.g. species sensitivity) a "BDBSA data restriction category" can be applied to the relevant data. The Data Manager authorises upload while restriction categories appropriately filter access.

Data extracted from BDBSA for "Non-standard outputs" (Item 9 in Figure 3), is intended primarily for internal use, that is, data analysis and the production of outputs for use in marine parks reporting. Extracted data therefore is considered similar to earlier data stages, i.e. a transitional stage for analysis and reporting outputs that ultimately form part of reports and other documents. As with the earlier data stages, this data is also considered to be 'For Official Use Only' based on the classification criteria. Reporting products (Item 10) derived from this data will undergo classification on a case by case basis, however, will generally be classified for "Public" distribution. In some instances where there is a justification, a caveat may be applied delaying release of the document pending approval for release by the document authority.

Licencing of the data and products classified "Public" will be applied based on the DEWNR licencing guidelines and a [Creative Commons Attribution](#) (CC BY) licence should be applied where possible. In the context of BRUVS data collected specifically for the MER program, use of the CC BY licence will be an appropriate "default" option, however, in cases where data has been collected in collaboration with 2nd parties, licencing and classification will need to be considered by the Monitoring, Evaluation and Reporting team using the respective guidelines on a case by case basis.

5   Appendices

5.1   BRUVS specifications

The DEWNR Biological Survey Team (BST) currently operates up to eight stereo BRUVS; six large units (1260 mm wide, 880 mm long, 660 mm high) and two smaller units (1070 mm long, 690 mm wide, 500 mm high). The larger type accommodates a pair of Panasonic HC-V700 video cameras and the smaller type, a pair of GoPro Hero 4 cameras.

A stereo BRUVS unit consists of the following:

- Stereo BRUVS frame (x 1) – SeaGIS Pty Ltd

- Custom waterproof video camera housing (x 2) – SeaGIS Pty Ltd

- Video cameras – GoPro Hero 4 or Panasonic HC-V700 (x 2)

- HandsTek synchronising diode mounted to a 1 m long steel arm (x 1)

- 1.5 m (long), 20 mm (diameter) PVC bait arm with a 200 mm x 250 mm plastic mesh bag attached to the end with cable ties.

- 5 kg steel ballast bars for attachment to the base of the frame when required

- 8 mm floating rope – length to be double the operating depth

- Surface buoys – 1 large and one small joined by 1 m of floating rope. This is attached to the main rope via a large shark clip.

The Panasonic cameras have a fixed 28 mm lens with a field of view (FOV) of 74°. The GoPro cameras have an adjustable FOV, and are set to medium (120°). The larger FOV of the GoPro cameras can be reduced during the video analysis stage to standardise the two camera types. All cameras are set to record in high definition (1920 x 1080 pixel resolution) at a frame rate of 50 frames/sec.

The HandsTek synchronising diode unit (supplied by SeaGIS) is mounted to a 1 m long galvanised tube attached to the front of the frame in view of the cameras. It is used to synchronise paired video images required for accurate length measurements.

A plastic mesh bait bag (250 mm x 200 mm) is mounted to the end of a 1.5 m length of PVC conduit. The conduit is inserted into the diode tube, and both are secured to the frame using a modified shark clip. The bait bag contains ~600 g of ground pilchards (*Sardinops* spp.). Grinding the bait through a 12 mm die maximises the dispersion of the bait plume, which serves to attract fish into the view of the cameras.

5.2 Data protocols

5.2.1 OpCode structure

OpCode is a unique identifier for each BRUVS drop. It is used to link MaxN, length, and site information data. <u>It is imperative to keep the formatting consistent.</u> It is made up of the following components:

(1) **Site code:** A descriptive code consisting of 4 letters (capitals). The letters describe the site name, orientation, and protection status. <u>The order of this lettering is fixed and should not be changed</u>.

    a. Letters 1 and 2 – The name of the site, preferably using the name of the sanctuary zone being surveyed.

    b. Letter 3 – Cardinal letter to describe the orientation of a site relative to the centroid of the SZ: **N** for north, **E** for east, **S** for south and **W** for west. **C** (central) is used to denote a site which lies between two cardinal sites.

    c. Letter 4 - Indicates if a site is in or out of a sanctuary zone: use **I** for inside, and **O** for outside.

(2) Replicate (drop) number made up of two digits (the first being zero for numbers less than 10)

(3) An **underscore** is used to separate the sitecode+rep and date components.

(4) **Date:** consisting of two digits representing year followed by two digits representing month e.g. March 2016 would be "1603"

Examples:

PISO02_1503

Site	Rep number	Separator	Year of sample	Month of sample
Pearson **I**sland **S**outh **O**utside	**02**	_	20**15**	**03** (March)

CLWI01_1311

Site	Rep number	Separator	Year of sample	Month of sample
CLinton **W**est **I**nside	**01**	_	20**13**	**11** (November)

SGCI04_1604

Site	Rep number	Separator	Year of sample	Month of sample
Sponge **G**ardens **C**entral **I**nside	**04**	_	20**16**	**04** (April)

5.2.2 Field data

Data from the field log sheets are used to create an Excel spreadsheet containing information for each video sample. An electronic template supplied by the Biological Survey Team contains the fields shown in Table 2.

Field headings must be entered <u>exactly the same</u> as they appear and are <u>case sensitive</u>. The worksheet <u>must</u> be called **BRUVS_Site** (spelled exactly). All fields should be formatted to "General" except for the fields **Date** and **TimeIn**. **Date** <u>must</u> be formatted to "Date" (dd/mm/yyyy), and **TimeIn** formatted to "Time" (24 hour – hh:mm:ss).

Table 2: List of fields contained in "BRUVS_Site" table (field logsheet and associated field collection data).

Field heading	Description	Allowed values
OpCode	Unique id for each BRUVS drop, includes 4 letter Site code, 2 digit drop no, year & month.	Text, (mandatory)
SiteName	Name given to the site where a group of BRUVs were dropped	Text
Waypoint	Original waypoint number or name from field sheets	Text
Latitude	Latitude, recorded in decimal degrees to 6 decimal places (0.1 m accuracy). Negative values indicate location in the southern hemisphere	Number, (mandatory)
Longitude	Longitude, recorded in decimal degrees to 6 decimal places (0.1 m accuracy).	Number, (mandatory)
MapDatum	Mapping coordinate system (e.g. WGS84).	Text
MapMethod	Indication of the precision (accuracy) of location data (horizontal coordinates, latitude and longitude).	Text, (GPS, DGPS, ODGPS, MAPS)
Date	Date of the BRUVS deployment.	Unique date for each survey visit
TimeIn	Time of BRUVS deployment.	Time (hours:min)
BruvType	Stereo or single BRUVS.	Text
UNIQUE_ID	Unique zone code (based on the full MP network), OR "99" for sites not in a Marine Park.	Number
UTMzone	Universal Transverse Mercator zone where the deployment was made.	Number
Easting	Longitude of the deployment converted to eastings.	Number (no decimal)
Northing	Latitude of the deployment converted to northings.	Number (no decimal)
FieldLead	Name of the field trip leader eg TCitizen	Text
FieldTeam	name of the group conducting the field work e.g. 'BST', 'KI', 'EP' etc.	Text
MonType	Type of monitoring to which the data will contribute – Core or Opportunistic.	Text
Bottom Temp	Temperature of the water at the sea floor (degrees Celsius).	Number

5.2.3 Data processed from videos

Data from processed videos is exported to an Excel spreadsheet containing information for each video sample. Data fields for MaxN are shown in Table 3 and data fields for Length are shown in Table 4 .

Field headings must be entered <u>exactly the same</u> as they appear and are <u>case sensitive</u>. The MaxN worksheet <u>must</u> be called "**MaxN**" (spelled exactly) and the Length table "Length". All fields should be formatted to 'General' except for the field **Time (mins)** which must be in text format.

Table 3: List of fields contained in the MaxN table (exported from EventMeasure).

Field heading	Description	Allowed values
FileName	Name of the video file used during analysis. Generated by software	Text
Frame	Frame number at which a measurement was made. Generated by software.	Number
Time (mins)	Video timestamp at which the measurement was made. Generated by software.	Number (text format)
OpCode	Unique ID for each BRUVS drop, includes 4 letter Site code, 2 digit drop number, year & month. Entered by analyst. Derived from field record sheet.	Text
TapeReader	Name of the analyst (for example: JBlogs).	Text
Depth	Water depth in metres at the location of the BRUVS rep/drop. Entered	Number

	by analyst. Derived from field record sheet.	
Comment	Any comments relating to the BRUVS rep/drop such as conditions, system problems etc. Entered by analyst. Derived from field record sheet and observation during video analysis.	Text
Habitat	Benthic habitat in the view of the BRUVS. Entered by analyst. Derived from DEWNR Video Codes schema for benthic video classification.	Text
Soak Time	Length of time (in minutes) the BRUVS spends submerged. Maximum 60 minutes. Entered by analyst. Derived from observation during video analysis.	Number
Bias	The proportion of sea floor visible in the video frame. Given as a score 1–3. Entered by analyst. Derived from observation during video analysis.	Number
FOV	The proportion of the video frame obscured by reef, seagrass or macro-algae. Given as a score 1–4. Entered by analyst. Derived from observation during video analysis.	Number
Vis	A measure of the water clarity. Given as a score 1–4. Entered by analyst. Derived from observation during video analysis.	Number
Family	Taxonomic family of the fish being measured. Derived from CSIRO CAAB codes file loaded into EM. Selected by analyst.	Text
Genus	Taxonomic genus of the fish being measured. Derived from CSIRO CAAB codes file loaded into EM. Selected by analyst.	Text
Species	Taxonomic species of the fish being measured. Derived from CSIRO CAAB codes file loaded into EM. Selected by analyst.	Text
Code	Unique CSIRO CAAB code identifier. Derived from CSIRO CAAB codes file loaded into EM.	Number
MaxN	The maximum number of a species counted in a single video frame.	Number
Has fed	Whether the individual was observed feeding (Yes/No).	Text

Table 4 : List of fields contained in the Length table (exported from EventMeasure).

Field heading	Description	Allowed values
Filename	Name of the video file used during analysis. Generated by software.	Text
Frame	Frame number at which a measurement was made. Generated by software.	Number
Time (mins)	Video timestamp at which the measurement was made. Generated by software.	Number (text format)
Length (mm)	The measured length of a fish. Generated by software.	Number
Precision (mm)	Mathematically derived estimate, based on physical camera properties and 3D intersection geometry. Generated by software.	Number
RMS (mm)	Root Mean Square intersection value for all points in a measured length. Should be <20 but ideally <10. Generated by software.	Number
Range (mm)	The distance from the mid-point of the stereo cameras to the mid-point of the measured length. Generated by software.	Number
Direction	The angle in degrees between a line from the mid-point of the camera system to the mid-point of the object being measured. Generated by software.	Number
OpCode	Unique ID for each BRUVS drop, includes 4 letter Site code, 2 digit drop number, year & month. Entered by analyst. Derived from field record sheet.	Text
TapeReader	Name of the individual processing a BRUVS rep/drop. Format example: JBlogs. Entered by analyst.	Text
Depth	Water depth in metres at the location of the BRUVS rep/drop. Entered by analyst. Derived from field record sheet.	Number
Comment	Any comments relating to the BRUVS rep/drop such as conditions, system problems etc. Entered by analyst. Derived from field record sheet and	Text

	observation during video analysis.	
Habitat	Benthic habitat in the view of the BRUVS. Entered by analyst. Derived from DEWNR Video Codes schema for benthic video classification.	Text
Soak Time	Length of time in minutes the BRUVS spends submerged. Maximum 60 minutes. Entered by analyst. Derived from observation during video analysis.	Number
Bias	The proportion of sea-floor visible in the video frame. Given as a score 1–3. Entered by analyst. Derived from observation during video analysis.	Number
FOV	The proportion of the video frame obscured by reef, seagrass or macro-algae. Given as a score 1–4. Entered by analyst. Derived from observation during video analysis.	Number
Vis	A measure of the water clarity. Given as a score 1–4. Entered by analyst. Derived from observation during video analysis.	Number
Family	Taxonomic family of the fish being measured. Derived from CSIRO CAAB codes file loaded into EM. Selected by analyst.	Text
Genus	Taxonomic genus of the fish being measured. Derived from CSIRO CAAB codes file loaded into EM. Selected by analyst.	Text
Species	Taxonomic species of the fish being measured. Derived from CSIRO CAAB codes file loaded into EM. Selected by analyst.	Text
Code	Unique CSIRO CAAB code identifier. Derived from CSIRO CAAB codes file loaded into EM.	Number
Number	The number of individuals measured.	Number
Stage	Life stage or gender of the measured individual.	Text
Activity	What the individual was doing at the time of the measurement.	Text
Comment	Any comments regarding the measurement.	Text

5.3 BRUVS video interrogation and processing using SeaGIS EventMeasure (Stereo)

5.3.1 Background

Video processing to extract BRUVS data from the footage collected in the field is carried out using commercial software specifically designed for event logging and measurement of fish communities (SeaGIS EventMeasure; http://www.seagis.com.au/). The use of this software is outlined in detail in the associated user manuals, however, some aspects of processing videos to extract BRUVS data are specific to DEWNR's BRUVS program. The following section draws on information from software manuals and details those more 'localised' aspects of data extraction for the MER BRUVS program.

5.3.2 Requirements for video analysis

- SeaGIS EventMeasure (EM) software installed
- Xvid video codec installed
- EventMeasure (EM) USB security key - supplied by the Biological Survey Team
- Hard drive with video, CAAB (CSIRO Codes for Australian Aquatic Biota) file, and CAM files loaded -supplied by BST
- Field data sheets – supplied by BST
- Reference books – Gomon et al. (2008) *Fishes of Australia's Southern Coast*, Edgar (2008) *Australian Marine Life*, Hutchins and Swainston (2012) *Sea Fishes of Southern Australia*
- Note book – keep written records and notes for each analysis. Include things like visibility, water movement, times of when events of note happen, problems, video quality etc.
- Two monitors are preferable as it can make analysis more efficient, especially during length measurements where each image can be expanded and viewed on its own monitor
- Familiarity with the detailed user manual supplied with the software. To access it, open EM, then click **About → User manual...** If the security key is unavailable, the manual can be found in the windows directory: C: / Program Files / SeaGIS / EventMeasure.
  The quick guide section of the EventMeasure software manuals is particularly useful for getting started

5.3.3 File types

Below is a list of file types used and/or generated by EM with which analysts should be familiar:

- Video file (**.avi**) – read only
- EventMeasure file (**.EMobs**) – user generated, (**.EMobs Auto**) – auto generated
- Attribute/species (.SPC, .TAB, **.TXT**) – read only CSIRO CAAB text file
- Measurement summaries (.SPC, .TAB, **.TXT**) – generated by the BST from .EMobs files
- Reference images and movies (**.jpg, .avi**) – user generated
- Camera calibration files (**.CAM**) – read only, required for length measurements

5.3.4   Recommended file structure

The file structure is important when working with EventMeasure. The hard drive provided by BST will have this structure already set. Processing will generate **EMobs** and **reference images** which should be saved in the correct folder (Figure 4).
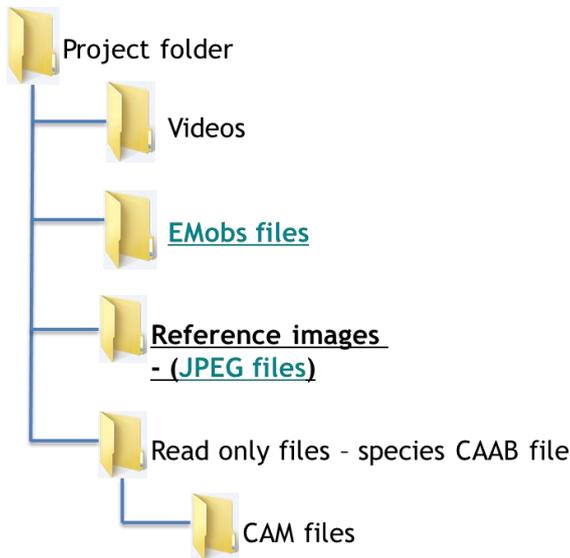

Figure 4: Recommended file structure

5.3.5   Setting up a new EventMeasure (EM) project

To set up a new EM project, follow the steps in the **Quick guide** section of the user manual.

Note: Accept any error messages that pop up regarding the CAAB species file (click **Cancel** then **OK**). It is only advising you that any duplicate or non-compatible records will be ignored.

5.3.6   Information fields

Information fields provide supplementary information (e.g. Field of View, Visibility) which is stored by the software with event (MaxN counts) and measurement (Length) records.

This stage of project setup is crucial to producing the complete output data set and information must be entered correctly. To edit the names: click **Measurement → Information fields → Edit field names** …. Double click to the right of the tick to enable editing of that field. Make sure the field names are entered exactly as they appear in Figure 5. Field names without a tick are fixed and cannot be edited. Only those with a tick can be user defined. This process should only be done once and remain set.
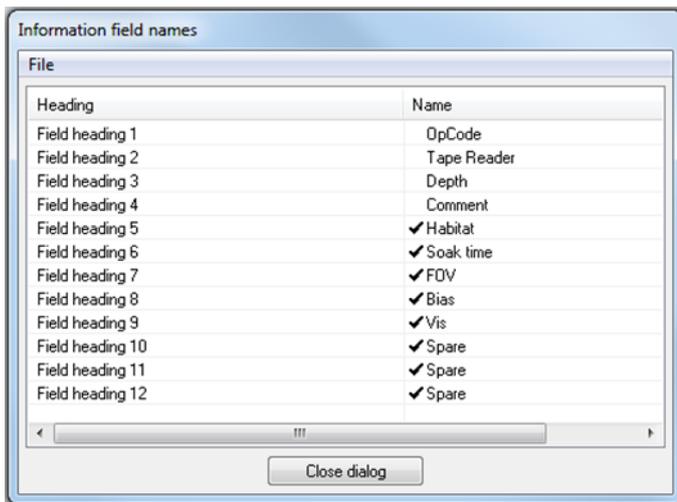
Figure 5: Required information field names (must be entered exactly as shown)

5.3.7 Field values and naming

The field values provide identification and physical information for each BRUVS drop. Some of the information is derived from the field log sheet and some from observing the video.

Before conducting any measurements, relevant fields must be entered (note, EventMeasure will not allow any measurements to be recorded until at least the OpCode and Tape Reader fields are entered). Field values can be changed by clicking **Measurement → Information fields → Edit field value,** then double clicking to the right of the tick to enable editing. The first three fields must be entered before performing the analysis. The other fields can be entered during processing. Below is a description of field headings used in the MER BRUVS program.

OpCode – The unique code given to each individual BRUVS drop (found on the field data sheet)

Tape Reader – The name of the person conducting the analysis. It should be entered in the following format, the analysts first initial as a capital letter followed by their second initial as a capital and the remainder of your surname in lower case, e.g. Dereck Smalls = "DSmalls".

Depth – The depth of water in which the BRUVS was deployed (found on field data sheet)

Comment – Any relevant comments regarding the analysis or comments from the field data sheet

Habitat – The habitat classification of the BRUVS deployment. <u>**Leave blank**</u>

Soak time – The total time in minutes that the BRUVS is resting on the sea floor (from touchdown until the end of the recording, or is winched up)

FOV – The field of view of the cameras or how much of the image is obscured (see below for details)

Bias – The up/down angle at which the cameras are pointing (see below for details)

Vis – a measure of water clarity (see below for details)

5.3.8   Image view parameters

Bias

Code:	Cam angle	View		Key
1		75% or more open water (facing upwards)		open water / benthos
2		50/50% open water and benthos (level)		
3		75% or more benthos (facing downwards)		
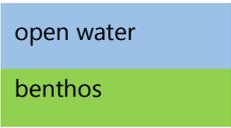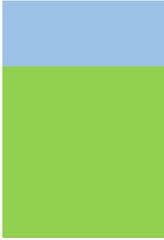
(FOV) Field of view

% view obstructed	Code
none	1
1/3	2
2/3	3
Full	4

Vis (Visibility)

Distance from cameras	Code
Cam to >4 m	1
Cam to 4 m	2
Cam to bait bag	3

5.3.9 Attribute headers

Attribute headers set the variable types offered when making fish record entries. Attribute names 1–7 are fixed and cannot be changed. Names should appear exactly as shown in Figure 6.
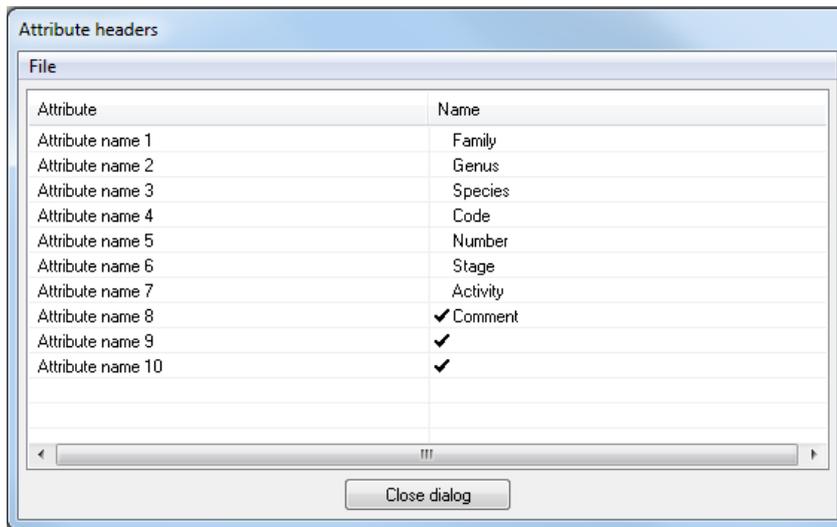
Figure 6: Attribute headers as they should appear in your software (attributes 9 and 10 are optional and can be left blank)

5.3.10 Making measurements

See the software manual and quick guide for details regarding synchronization of images and making measurements.

5.3.11 Submitting data

Data must be submitted to the Biological Survey Team. Once analysis is complete, EMobs files can be copied to a new folder which should be zipped for emailing. Small files such as text and EMobs files can be emailed without issue. Larger files (images and video) can be problematic for the email system so *Dropbox* or a similar solution is recommended.

5.3.12 Contacts

All questions and data submission should be directed to the **Biological Survey Team**:

GPO Box 1047, Adelaide SA 5001 AUSTRALIA

5.4 BRUVS data preparation for BDBSA

5.4.1 Introduction

This section outlines the data management process for taking BRUVS data produced in the video processing stage and preparing it for upload to the Biological Databases of South Australia (BDBSA). The process described represents the transition from the last stage of processing (Item 3) through to data storage in BDBSA (Item 5), illustrated in Figure 3. The processes described, results in the production of three comma separated data files (Item 4) which can be directly uploaded to BDBSA by a member of the DEWNR database management support team (DEWNRBioDataSupport@sa.gov.au).

5.4.2 Post processing data preparation and formatting

Following processing of the BRUVS videos, a BST member batch exports the processed data using the "batch text file output" utility in EventMeasure to create tab delimited text file outputs for both **MaxN** and **Length Measurements** from all of the processing files (EMobs). The "file concatenation" utility in EventMeasure is then used to merge all of the **MaxN** and **Length** text files respectively.

The concatenated text files are then opened in Excel (using **"Delimited → Tab → General"** in the Text Import Wizard) for data checking and formatting.
The following actions are performed on MaxN and Length data file respectively:

MaxN data

1. Delete the following unused columns: **Period**, **Period time** and any columns with no heading.

2. Ensure the column headings are formatted and spelled exactly as they appear in Table 3.

3. The entries for the user defined fields "OpCode" and "TapeReader" must be checked so the spelling and formatting match those in Appendix 5.2 and Table 3.

4. Check that all cells have the appropriate entry as per Table 3.

Length measurement data

1. Delete the following unused columns: **Period**, **Period time**, **Horz. Dir**., **Vert. Dir**., **Mid X**, **Mid Y**, **Mid Z** and any columns with no heading.

2. Ensure the column headings are formatted and spelled exactly as they appear in Table 4.

3. The entries for the user defined fields OpCode and TapeReader must be checked so the spelling and formatting match those in Appendix 5.2 and Table 4.

4. Check that all cells have the appropriate entry as per Table 4.

Once complete, the files are saved in Excel workbook format (.xls) in the appropriately named working folder under processing archive with the appropriate naming convention (e.g. "Name of Survey_Length_1512" and "Name of Survey_MaxN_1512".

Worksheets (MaxN & Length) are then combined into one Excel file/workbook along with a third worksheet containing the Site information and saved as per the data protocols in Appendix 5.2. The Excel workbook must contain three spreadsheets, "**MaxN**" which contains Fish counts, "**Length**" which contains fish length measurements, and "**BRUVS_Site**" which contains the GPS position and field datasheet information. Note: it is important that column headings and worksheet names are **exactly** as prescribed in Appendix 5.2 or the BRUVS BDBSA data preparation tool will not work. The Excel workbook is saved in a specific location to which the database refers, under a name appropriate to the survey trip (for example "BRUVS_2015_CapeduCoudic").

5.4.3 BRUVS BDBSA data preparation tool

The data preparation tool is an MS Access database which links to data in the appropriately named and formatted video processing output file described above and produces three text files ("SITE", "VISIT" & "SPECIES") in a format for direct upload into BDBSA. Structure of the database tool is shown in Figure 5.

To create these BDBSA upload files, the Excel workbook to be processed is copied from the "PENDING" folder and saved in the "DATA_FOR_UPLOAD" folder (i.e. up one level) with the name; "**MSAccessBDBSAinput.xlsx**" (*note: naming and storage location must be exact for the tool to work correctly). The BDBSA data preparation tool links directly to this file and the worksheets within ("MaxN", "Length" & "BRUVS_Site").
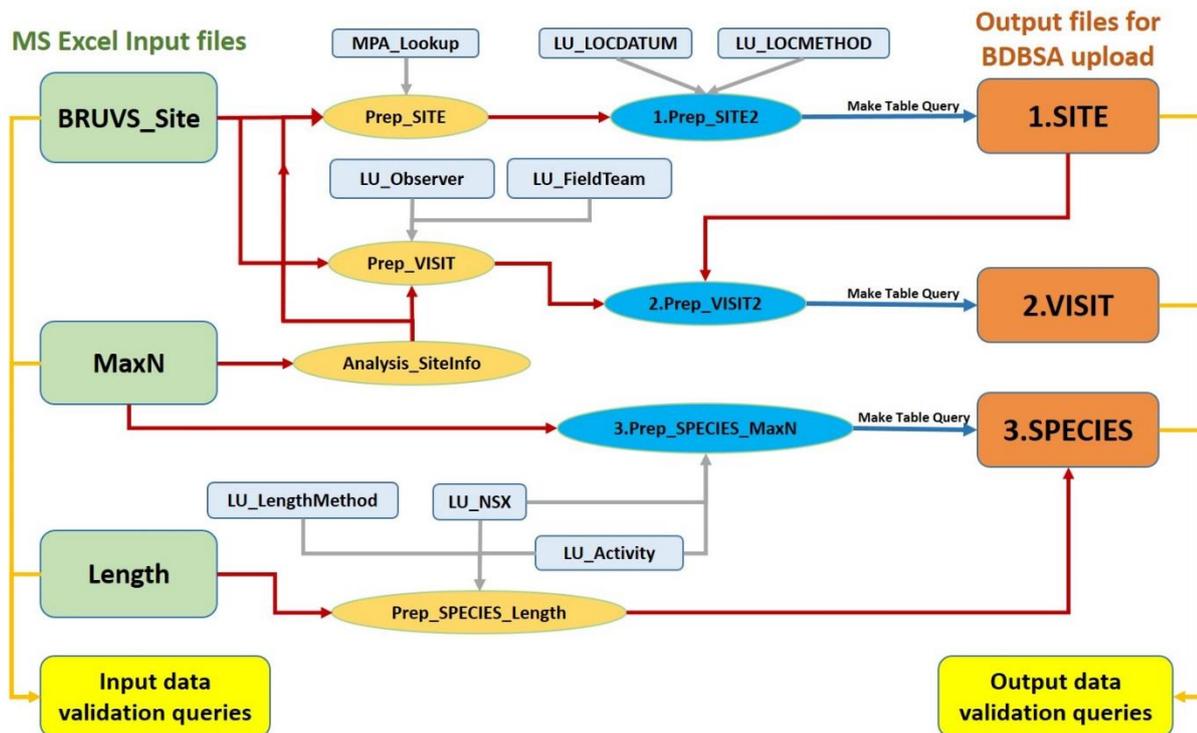

Figure 7: Illustration of the BRUVS BDBSA data preparation tool database structure.
Boxes represent data tables (green=inputs, light blue=lookup tables, orange=outputs) and ovals represent queries (blue='activated' queries, light orange=intermediate queries i.e. not activated by the user). The two yellow boxes represent groups of queries that are activated to validate incoming and outputted datasheets.

To produce the three files, three steps are required:

(1)   Validation of incoming data:

     a.   Ensure the Excel file is saved in the correct format and location as per instructions above

     b.   **Open the database tool** and if still present, delete previous versions of the "SITE", "VISIT" and "SPECIES" tables.

     c.   **Check that linked tables are functioning** (i.e. double click each of the tables, "BRUVS_Site", "MaxN" and "Length", which all have an adjacent Excel icon, and open them) and confirm they contain the data from the desired locations to be uploaded.

     d.   **Run all "Validate___" queries***

(*Note: By right clicking any of the queries and opening "object properties", the user will find a description of what the query does and what to look for. This also applies to the queries described below)

(2) Data processing (which creates the three output files):

    a. **Run** the MakeTable query **"Prep_SITE2"** (a new "SITE" table should be created if successful).

    b. **Run** the MakeTable query **"Prep_VISIT2"** (a new "VISIT" table should be created if successful).

    c. **Run** the MakeTable query **"Prep_SPECIES_MaxN"** (a new "SPECIES" table should be created if successful, open and check no of records).

    d. **Run** the Append query **"Prep_SPECIES_Length"** (the no of data records in the "SPECIES" table should increase if successful).

(3) Post Validation and export:

    a. Check that the number of records in the "SITE" table match that of the original "BRUVS_Site" table, and that the number of records in the "SPECIES" table match the combined number of records for the "MaxN" and "Length" tables.

    b. **Run** query "**PostValidate_MethodNR**" to ensure all length records have an associated "Length Method" number. The query will show any problem records. These must be fixed and the SPECIES table regenerated (Steps 2c & 2d above) and the check rerun. The most likely reason for a problem is a missing record (Genus & associated length method) from the lookup table "LU_LengthMethod".

    c. **Run** query "**PostValidate_Start&EndDate**" to make sure date range is correct for the surveys being loaded. If wrong, check the input files and then rerun from 2a.

    d. **Run** query "**PostValidate_NSXcodes**". This query checks for records that haven't been assigned an NSX code. Problematic records will appear (i.e. if the query produces an empty table, there are no problematic records). Errors are likely due to either a new species that is not yet in the table "LU_NSX" or because an incorrect CAAB code is in the input data tables ("MaxN" or "Length").

    e. **Export the three tables** "SITE", "VISIT" and "SPECIES" as Excel files (right click the table, select export, select excel) into the appropriate folder.

5.4.4 Output data files for BDBSA

Files (Excel format) produced from the previous steps require conversion to comma separated format before performing a test upload (see details below). This is done as follows:

1. "**SITE**" spreadsheet:
    a. Open, save as, "SITE_***.CSV" in the same location. (*** denotes part of the filename relating it to the data collection location e.g. SITE_Pearsons.CSV and will differ for each upload)

2. "**VISIT**" spreadsheet:
    a. Open,
    b. Delete "CAMPMAP"
    c. Save as, "VISIT_***.CSV" in the same location.

3. "**SPECIES**" spreadsheet:
    a. Open,
    b. Delete column "CAMPMAP".
    c. Delete column "SPECIES".
    d. Highlight and select all data in the "SURVEYNR" column and convert to a number format
    e. Save as, "SPECIES_***.CSV" in the same location.

5.4.5   Loading to BDBSA

This process starts with a 'test' loading of the data to detect any errors prior to actually uploading the files to BDBSA. This process must be performed by someone with some familiarity with BDBSA and who has been given access to the "BDBSA_TEST" environment. The test upload is performed by following the instructions starting from page 29 in the BDBSA Electronic Load Tool User Instruction Manual.

Once the comma separated text files have been successfully uploaded in the test environment, they are ready to be uploaded to BDBSA. This is currently achieved by emailing a link to, or copies of, the three text files to the DEWNR database support team (DEWNRBioDataSupport@sa.gov.au). They will in turn advise when the upload is complete. Once loaded to BDBSA, the three "csv" files will be archived in the Corporate BioDataStore.

Finally, update the BRUVS data tracking record.

5.5 Procedure for the extraction of data from BDBSA to the MS Access analysis database

5.5.1 Background

This section details the use of a relational database (**Error! Reference source not found.**) used to extract data irectly from BDBSA to produce tables in a format that is familiar and meaningful for those likely to be involved in the analysis of data for the Marine Parks MER Program. The aim of this tool is to provide a semi-automated process by which data analysts can easily and quickly extract data from BDBSA (the 'Point Of Truth' for the BRUVS dataset) without having to rely on those with access to BDBSA and knowledge of its data formats (however, a password for the system is required). In addition, the data output can be easily and efficiently transferred into familiar platforms for flexible and customisable data manipulation (generally MS Access and Excel).

A schedule of outputs from this tool (3 monthly) will make data updates available for the team in a shared location on the DEWNR network. However, custom, up-to-date outputs can be generated anytime by members of the team that are familiar with the tool and by following the step by step procedure below.
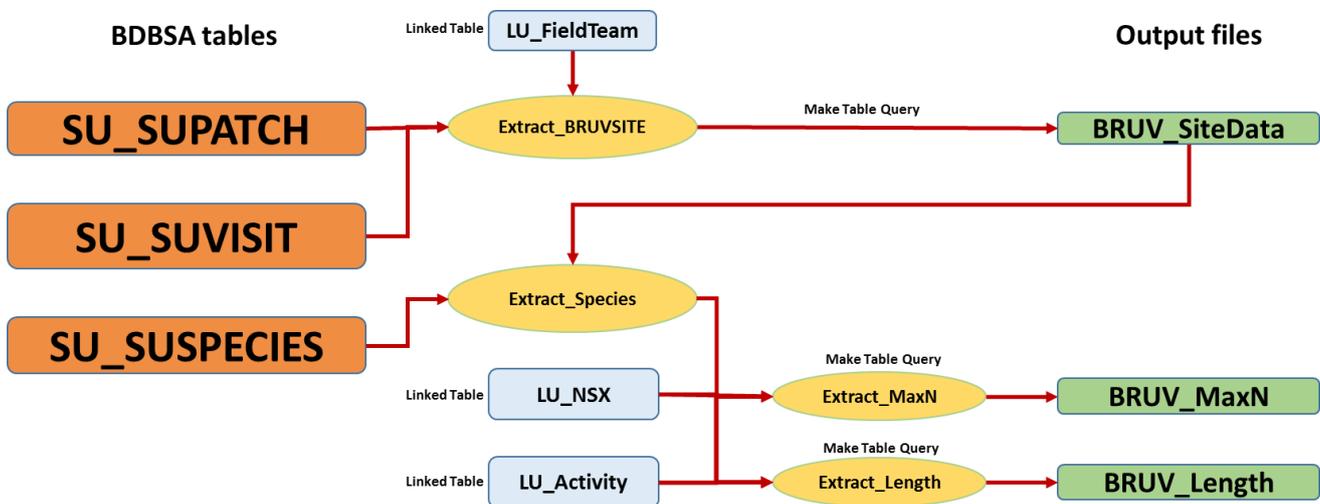

Figure 8: Illustration of BDBSA data extraction tool.
The tool (MS Access database) links directly to the "PATCH", "VISIT" and "SPECIES" tables in BDBSA (shown in orange) and uses a series of queries (shown in yellow) along with 'lookup' information from several data tables used in preparing the data for BDBSA (blue) to produce three tables (Site information, MaxN and Length data; shown in green) in a format appropriate for exploration and analysis.

5.5.2 Procedure

This section describes the procedure to produce three up to date BRUVS data tables ("BRUV_Lengthdata", "BRUV_MaxN" & "BRUV_SiteData") directly from BDBSA. These tables are made available for analysis and reporting purposes in MS Access or Excel formats. The procedure requires the following steps:

Through Citrix, Open MS Access, then open the extraction database.

(1)   **Run** query **"Extract_BRUVSITE"**

(2)   **Run** query **"Extract_MaxN"**

(3)   **Run** query **"Extract_Length"**

The tables can then be exported (by right clicking on the table, selecting "export" and following the instructions) to the database "BRUVdata_BDBSA" (see link above) where it is available to all team members. Exports to other formats can also be made, however if any data manipulation is required prior to exporting (e.g. a truncated dataset etc.), this should be done in "BRUVdata_BDBSA.accdb" or a separate database or spreadsheets.

Finally, the update should be noted in the "UPDATES" table in "BRUVdata_BDBSA.accdb" and in the BRUVS data tracking record.

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