



NMBAQC Video Ring Test:

Workshop Proceedings

Envision Mapping Ltd.

MARCH 2010

Horsley

Newcastle upon Tyne

UK

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| Prepared for | NMBAQC | | | | |
| Title | NMBAQC Video Workshop Proceedings | | | | |
| Abstract | Proceedings of a two day workshop held at the Centre for Life, Newcastle upon Tyne, 13 th & 14 th May 2009. Workshop was to discuss and develop a video ring test for QA & QC of video analysis and data collected for marine surveys | | | | |
| Contract reference: | 2007-1017-NMBAQC-Video Ring Test Pilot | | | | |
| Report identification: | 2007-1017-ISS- Workshop Proceedings V0 | | | | |
| Document control | | | | | |
| Rev. | Originator | Date | Status | Reviewed | Checked & Approved |
| 0 | Ian Sotheran | 19/05/09 | First Draft | JE | |
| 1 | Ian Sotheran | 15/06/09 | Second Draft | JFS | |
| 2 | Ian Sotheran | 22/06/09 | Third Draft | JFS | |
| 3 | Ian Sotheran | 24/06/09 | Final Draft | | |
| | | | | | |
| File index: \\Envisage\Projects\2007-1017-NMBAQC-Ring Test\Workshop\NMBAQC Video Workshop Proceedings V3.Docx | | | | | |
| <p>Prepared by Ian Sotheran Envision Mapping Ltd. 6 – 9 Stephenson House Horsley Business Centre Horsley , Northumberland NE15 0NY UK T:+44 (0)1661 854 250</p> | | | | | |
| NOTES: | | | | | |

Table of Contents

NMBAQC Video Ring Test: Workshop Proceedings..... 1

Introduction 5

 Workshop Background..... 5

 Workshop Aims 5

Day 1 – 13th May 2009 7

 Session 1 – The Test So Far 7

 Session 2 – Topics for Discussion..... 8

Day 2 – 14th May 2009 11

 Session 3 & 4 – Breakout Groups and Reporting Back 11

BREAKOUT GROUP A: NOTES OF MAPPING AND BIODIVERSITY MONITORING BREAK-OUT GROUP DISCUSSION 11

 Tool & Resources..... 11

 Best Practice 11

 Test Assessment..... 11

 Training and Testing..... 12

BREAKOUT GROUP B: NOTES OF FISHERIES AND MONITORING ISSUES AND OBJECTIVES BREAK-OUT GROUP DISCUSSION 12

 Taxonomy 12

 Enumeration..... 13

 Assessment of Disturbance..... 13

 General Points of Discussion..... 13

Session 5 – The Way Forward / Workshop Outcomes..... 14

 Best Practice 14

 Tools & Resources 14

 Training 14

| | |
|---|----|
| Testing..... | 14 |
| Test Assessment..... | 15 |
| Funding Considerations..... | 15 |
| Summary..... | 16 |
| Action Points..... | 16 |
| Appendices..... | 17 |
| Appendix 1: Workshop Agenda..... | 17 |
| Appendix 2: Workshop Participants..... | 19 |
| Appendix 3: Resources..... | 21 |
| (a) Resources that participants generate..... | 21 |
| (b) Resources that participants use..... | 21 |
| (c) Resources that participants would like..... | 22 |
| Appendix 4: Uses of Video..... | 24 |
| Appendix 5: Presentations..... | 25 |

Introduction

The NMBAQC Scheme was originally developed to meet the needs of the benthic biology component of the UK national monitoring plan. The scheme has since had its remit widened to include work undertaken for the habitats and water framework directives. It aims to assess the reliability of data collected and, more generally, to improve the standards of marine data collection and taxonomic identification in the UK.

Quality control is a key element of any monitoring programme. Achieving quality controlled taxonomic identification is a requirement of DEFRA and the devolved administration.

Remote photography and video is increasingly being used in survey and monitoring work as a means of investigating the benthic environment. Video provides a permanent record, can be used in locations perhaps inaccessible by other means, is able to be manipulated using computerised methods and is a non-destructive way to get information about habitats and species that may well be fragile or endangered.

Workshop Background

In April 2007 a workshop was convened by NMBAQC in Belfast to bring together users of benthic video. The aim was to see if there were common AQC needs across agencies and whether a universal AQC scheme was possible. While there are many different end uses of survey image, some generic elements of all programmes were identified:

- Taxonomic resolution – how detailed/specific can identifications be?
- Enumeration/coverage estimates – how should this best be done?
- Metadata - what metadata are required to interpret footage?
- Quality – can we come up with a grading system for footage?

It was agreed that a universal scheme was possible and that a pilot scheme should be set up to determine the shape of the eventual scheme.

This pilot scheme was started in June 2008 and consisted of 3 trial ring tests through the course of a year. The tests were completed by participants from a variety of organisations and, following feedback from each test, the subsequent test was refined.

Workshop Aims

A workshop was also carried out to review the pilot scheme. This workshop aimed to present:

- The reasoning behind why the test was piloted;
- How the proposed test had been developed;
- Feedback on aspects of completing the test.

The workshop also aimed to address four aspects of the Video Ring Test scheme in the context of two themes:

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| THEME 1: Fisheries and Monitoring Issues and Objectives |
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| THEME 2: Mapping and Biodiversity Monitoring Issues and Objectives |
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- | |
|--|
| <ul style="list-style-type: none">• What Tools and Resources are required? |
|--|

- What is Best Practice for video analysis?
- How should the Ring Test be assessed?
- What are the Training and Testing requirements?

Breakout groups discussed and debated these issues and reported back to the workshop with a view to reaching a consensus opinion.

A final session reviewed all the issues discussed and summarised the workshop findings.

Day 1 – 13th May 2009

Session 1 – The Test So Far

Background to the NMBAQC Video Ring Test QA

NMBAQC Representative – Matthew Service, AFBI

A general background to the origins of the NMBAQC schemes was presented. Also the requirements for data to be of a professional and quality-assessed standard were outlined.

The aim of the video ring test and other NMBAQC schemes is to provide a resource which enables organisations to meet and be tested against these standards whilst also raising the profile of quality assurance and controls within the industry.

Development of the NMBAQC Video Ring Test

Judy Foster-Smith – Envision

The process of development and refinement of each of the 3 trial tests were described.

Test 1 was a detailed test, the aims of which were

- To establish the general abilities of the participants;
- To produce information that would help to refine the test.

The outcome of this test showed that simplification was needed and that online form submission would assist both the participants completing the test and the analysis of the submitted data.

With this in mind Test 2 was simplified and a website developed to enable online data entry. The content of the test was also simplified: the number of clips which were to be used for the biological and the physical feature analysis was reduced and the amount of data which were to be extracted from each video clip was also reduced. However, an 'Index of rugosity was introduced in an attempt to gauge habitat complexity.

The main aims of Test 2 were:

- To continue refining the basis of the Ring Test: i.e. to test candidates':
 - § Substrate recognition skills;
 - § Substrate abundance assessment skills;
 - § Species ID skills;
 - § Species Abundance assessment skills;
- To test the effectiveness of using still images in helping to analyse video;
- To introduce and trial a marking scheme.

As a result of this test, it was recognised that it is very difficult to agree an absolute right answer for data analysis from video. Participants' performance was therefore compared with the 'mode' as the 'yardstick'.

On this basis all of the participants achieved a $\geq 69\%$ for substrate analysis. The main difficulty people had was distinguishing between some of the substrates e.g. gravel/course/fine sand.

For the biological features analysis – the test organisms were specifically selected and marked on the video – in other words they were 'known'. As these were 'known' organisms the answers could easily be marked right or wrong or given a mark in between, depending on how close the answer

was to the appropriate taxonomic group. Overall 65% of the identifications allocated by participants were correct.

The main lessons learnt from Test 2 were that aspects of the marking scheme needed to be addressed; that the difficulty of recognising different sediments on video needed to be addressed; and that the substrate data entry component needed modification.

Test 3 was again a simplified version of the previous test with abundance and rugosity scales altered slightly.

Results of test 3 are still to be reviewed.

NMBAQC Video Ring Test: Feedback from an Independent Consultancy

Nigel Thomas & Alison Bessell - EMU Ltd.

EMU Limited is an independent consultancy with good experience of video data collection and analysis. The organisation participated throughout the pilot scheme and presented feedback on the 3 trial tests and their development from a participant's point of view.

Test 1 – This was long and involved and included the allocation of lifeforms and biotopes, but this was an understandable level of information to allow for refinement of the test to a level for a marketable QC scheme. There was an obvious progression throughout the trial tests with the test becoming simpler and less onerous but some information required was problematic, especially percentage cover assessments.

The resources supplied could have been better explained, especially the rugosity index.

The test focused on species ID & substrate analysis which are a starting point for categorising video to lifeform or biotope. The use of SACFOR is difficult to apply to video and percentage cover or numerical abundance would be better suited, although SACFOR does account for variable size and growth forms.

The trial tests were not appropriate for those with little experience and some epifaunal id experience should be gained prior to carrying out video analysis.

In summary, we fully support the initiative and feel that QC is essential to maintain consistency data across the industry. A high level of ability should be attained prior to participation particularly with respect to species identification.

Session 2 – Topics for Discussion

NMBAQC Video Ring Test: Summary and Issues for 'Breakout' Sessions

Ian Sotheran – Envision Mapping Ltd.

A brief summary of the issues and themes for discussions were presented along with the issues to be discussed during the breakout groups.

Tools & Resources

- Online tools

- Reference list and libraries

- How to rate video footage

Survey guidance?
Enumeration tools & methods
Own sample tests
Specific id guide/workshops?

Best Practices

Test Assessment

Training & Testing

NMBAQC Video Ring Test: Fisheries and Monitoring Issues and Objectives

Roger Coggan – CEFAS

The use of video as applied to a fisheries perspective and how the systems were used was introduced.

Video used within fisheries and monitoring focuses on stock assessment and evaluation as well as physical impact assessment and habitat health assessment and monitoring.

Fisheries stock assessment using video is routine and QA/QC methodologies are currently employed internally to ensure consistency. These methods particularly apply to *Nephrops* burrows and seed mussel distribution and relocations.

Physical impacts on habitats and general habitat health is/can be assessed from video footage. This can be dependent upon the physical nature of the substrate, the scale at which the survey is carried out and the speed at which video footage is reviewed. It was noted that trawl impact marks are recorded with less difficulty when footage is played at high speed.

The methods and quality assurance methodologies for benthic video analysis used in other countries was noted. Norway is about to publish recommended operational guidelines for video data collection, analysis and review. Also, Canada has a training scheme in place for sediment composition assessment which involves a pass/fail assessment.

NMBAQC Video Ring Test: Mapping and Biodiversity Monitoring Issues and Objectives

Rohan Holt – CCW

The objective with regard to QA/QC is to increase consistency of approach with regard to scoring video information so that inter-surveyor variability is reduced.

Applications range from basic habitat mapping, biotope 'spotting', biotope description or characterisation of habitats through to monitoring of biotopes and species. A progressive level of detail/resolution is required for each of these respectively.

At present results indicate a wide range of variability in the ability to score video, and that local knowledge or familiarisation with an area can reduce this. An example of a diver exercise was used to illustrate how pre-survey learning and familiarisation along with consistent recording methods and 'rules' can reduce variability.

Lessons could be learned and applied to video analysis so that local experts or data owners may be considered to hold the 'correct' answers or at least a result which is at an acceptable level.

A summary of what a ring test could include was proposed with pre-test familiarisation material circulated to candidates before the test material is circulated to give enough time for candidates to become familiar with the local environment. Use local experts to score the video and provide the 'correct' answers. Bray Curtis similarity could be used to assess whether candidates pass or fail dependent upon the significant difference of their responses from the experts' results.

In general summary, ring tests will only illustrate how variable people are. To score video analysis, local knowledge is paramount. The principles learnt from the diving work illustrated could be adapted and applied to video ring testing. If training tools and aids are needed then a huge amount of work is required.

Day 2 – 14th May 2009

Session 3 & 4 – Breakout Groups and Reporting Back

BREAKOUT GROUP A: NOTES OF MAPPING AND BIODIVERSITY MONITORING BREAK-OUT GROUP DISCUSSION

The following notes were made during the discussions:

Tool & Resources

Suggested requirements include:

- An annotated video image library (including both species and substrates);
- Video clips on YouTube;
- Video, stills and grabs (all ground-truthing techniques) should be routinely provided from benthic surveys;
- A tool for substrate abundance assessment (– a ‘grid’ over frames at regular intervals?)
- Still images of algae (e.g. those provided for NMBAQC macro-algal QA Test);
- Top-down fish ID images;
- Details of the GEOHAB Norwegian Video Conference details –Roger Coggan to provide?
- List of species recognisable from video prioritised according to degree of ‘recognisability’;
- Peer-reviewed annotated still images of identified species;
- Non-dichotomous keys similar to the Australian ‘INT-Key’ series;
- Provide a template for resources (e.g. Images) on the NMBAQC website;
- People to list any resources they (a) Generate, (b) Use and (c) Would like (see Appendix 3);
- A centralised management structure for dealing with ‘Resources’ Information.

Best Practice

- Training should be aimed at a range of levels from ‘generic’ to ‘local’;
- Procedural guidelines (‘Best practice’) should include both generic and local details (e.g. on spp. ID);
- Test feedback should be provided on weaknesses and inherent variability within the system;
- Organisations should have their own, internal QA procedures;
- Have ‘local people’ decide what level of ID can be achieved for video taken in their ‘patch’;
- Involve ‘local’ guidance and, as far as possible, use area-specific contractors;
- It is important to define and emphasise the purpose of analysis;
- There need to be standards for both training and testing.

Test Assessment

- There is a need for a ‘Yardstick’ against which to assess candidates; these could be provided by:
 - Owners of video setting the ‘correct’ answers;

- Having a team of 'experts' to set 'correct' answers;
- Establishing how a group of 'experts' perform and use this as the 'acceptable variability' range for assessment.
- The 'Yardstick' for assessment should be linked to the purpose of the analysis.
- Only assess people who have been given training material and 'Best Practice' guidelines;
- Individual components of the Test should be marked separately to help identify areas of weakness – for improvement;
- Test individuals but results can be amalgamated as an 'organisation' response.

Training and Testing

- There could be two ways of testing:
 - i. a standard test;
 - ii. a submission of the organisations' own clip of video together with analysis to be assessed.
- There could be two types of Test:
 - i. A 'Standard' basic test
 - ii. A 'Specialist' Test – purpose driven e.g. fisheries/biodiversity.
- There should be an 'Improvement' process: with candidates having to keep taking the Test until they have got to the approved standard.
- There should be an emphasis on training over testing:
- Training on the assessment of abundance (%cover, SACFOR and counts) is vital.

BREAKOUT GROUP B: NOTES OF FISHERIES AND MONITORING ISSUES AND OBJECTIVES BREAK-OUT GROUP DISCUSSION

The following notes were made during the discussions.

The themes of discussion were separated into three topics based around:

Taxonomy

- There is requirement for Keys & Guides
 - Existing ones are used but there is a requirement for more specific video guides / image catalogues & examples
 - § There is then a risk of identifying only what is in the guide.
 - There may be a requirement for specific guides on:
 - § Burrows / Structures
 - § Fishing Marks
 - § Anthropogenic Impacts
 - § Cryptic Species
 - § Invasive Species
 - § Egg Cases

- Is there requirement for guidance or rules on to what level video analysis is taken?
- Video should be graded/scored for suitability / fit for purpose.

Enumeration

General discussions revolved around the ability to count 'things' from video footage. This included points on which statistical tests can be used, guidelines on how to count or enumerate which would reduce operator variability, for example, how many times should footage be viewed? How and where should video be viewed? Guidelines on video review methodology are required. Certain metadata or features of video footage should be a requirement before video footage is deemed suitable for the extraction of data for statistical testing. Most important features were scale indication on the video footage and the time or distance travelled which may be possible by the use of GPS overlay.

Assessment of percentage cover was found to be difficult and problematic with guidance on the points below thought necessary;

- Percentage Cover:
 - How to estimate sediments;
 - Change in sediments;
 - Sectioning Video.
- Guidance on count or percent cover.

Assessment of Disturbance

- Covers large areas and enables other samples to be viewed with perspective
- Gross Features are and can be recognised

General Points of Discussion

General points for summary included:

- Best Practices
 - Scale – this a requirement for quantitative data extraction
 - Sound – could this be useful for assessing video footage?
- Standard Procedures - what is already available and can be circulated? Or are new procedures required?
- Schedule & Time Implications
 - Client & Contractor – Parts of the test were thought to be onerous by contractors but if the costs are passed onto client then this may not be an issue.
 - Does the volume of work available justify the cost was an issue raised? Is there enough contract work available which will allow for contractors to invest in the training and participation within the scheme?

Session 5 – The Way Forward / Workshop Outcomes

Much of the discussion during this session was a continuation and development of that which took place during the 'Break-out' sessions (Sessions 3 & 4 Above). However, the key points that were broadly agreed are summarised consecutively as outcomes of the workshop below.

Best Practice

1. It was recognised that a series of standard protocols (or 'Standard Operating Procedures' [SOPs]) are required for the QA process, including:
 - 'Best Practice' guidance manuals for carrying out video analysis;
 - Standards for training and testing.

Tools & Resources

2. There are two fundamental 'Tools and Resources' requirements for the video analysis QA process:
 - The provision of a standard protocol for video analysis (see above);
 - Resources to train contractors to work to the protocol.
3. The production of procedural protocols on video analysis should:
 - Start by the collation and reviewing of existing protocols;
 - Involve a series of drafts for feedback and revision to develop a 'Best Practice' manual.
4. There should be a centralised management structure for dealing with 'Resources information'.
5. A 'Resources' list should be included in the NMBAQC website. (A separate list of resources that are (a) already generated, (b) currently used and (c) required is given in Appendix 3).

Training

6. The emphasis of the QA process should be on training.
7. There is a need to collate and review the information required to train contractors in video analysis (see 'Tools & Resources' above).
8. There is a need to assess the effectiveness of training (- it was suggested that this could be done by running a Test, carrying out Training, and running the same Test again).
9. Workshops would provide a suitable training environment. Training on the following are vital:
 - 'In situ' species identification;
 - Substrate/Habitat recognition;
 - Enumeration techniques (i.e. counting, assessing SACFOR and % cover) - may need to reinvent abundance assessment techniques specifically for video analysis;
 - New technologies (keeping abreast of developments that improve quality of benthic video and its analysis).
10. Training could be funded by charging contractors to be trained - contractors could then pay only for their specific training needs.

Testing

11. There could be two methods of testing: (1) By a standard form of Test with several selected video clips– similar to that developed by Envision and (2) by the submission of a candidates' own video clip which they have analysed.

12. There could be two types of Test in terms of content: a general (standard) Test and a specialist (purpose-driven) Test. Organisations could then opt for the Test that is of most relevance to them.
13. Frequency of testing? The following strategies for testing were suggested:
 - One Test per year. It was suggested that this could be done:
 - When convenient during the calendar year (with Test being marked for all candidates together early the following year);
 - At fixed times so that candidate organisations can plan and marking can be done and feedback given immediately.(The latter option was preferred).
 - Twice a year (early spring and late autumn – to avoid survey season) on fixed dates, again with a turn-around time on marking and feedback that is appropriate.
14. Refinement of the Testing process should include:
 - Video clips used for the testing procedure should be at as high a resolution as possible;
 - A list of species that are identifiable on video should be compiled and a 'drop down' list of these species should be provided on the Test 'Biological Data entry' response form;
 - Building a 'library' of Tests for practice runs.
15. It is important that Test participants are given feedback indicating the fine details of their strengths and weaknesses (for remedial action if appropriate).

Test Assessment

16. Test should be marked by NMBAQC Assessors.
17. The different components of the Test (however small) should be marked separately – then candidates can be given feedback specific to their particular strengths and weaknesses (for remedial action if appropriate).
18. Marking requires an agreed 'yardstick' against which to assess candidates' performance; there are several options:
 - 'Owner' of video to set 'correct' answers as yardstick;
 - Create team of taxonomic experts to set taxonomic level to which organisms can realistically be identified on video;
 - Create team of 'Substrate recognition' experts to set 'correct' substrate abundances;
 - Use 'average' mark as yardstick for pass/fail;
 - Use the performance of a group of experts as the acceptable level of variability.
20. Allocation of Pass/Fail results would be carried out by NMBAQC committee.

Funding Considerations

21. NMBAQC Committee to explore funding opportunities – DEFRA? Windfarm industry? Crown Estate?
22. The development of the different aspects of training should each be costed on a separate basis.
23. Training could be funded by charging contractors to be trained (see 'Training and Testing' above).
24. NMBAQC committee to decide on possibility of proposing a longer (3-year?) contract to take both training and testing forward.

Summary

25. There should be 'stages of development' of the whole process, for example:
- i. Review existing video analysis procedures;
 - ii. Produce a 'Guide to Video Analysis' manual;
 - iii. Train potential video analysis contractors;
 - iv. Create and carry out a simple Ring Test (which would be only part of the whole QA process);
 - v. Hold a workshop to review manual/training/testing procedures;
 - vi. Hold regular workshops to review.
26. It was felt that it is important to keep the momentum of the project going and that the cohesion of the group attending the workshop should be kept by involving everyone at the next stage.

Action Points

27. It was agreed that the Organisations present would:
- Provide a 3-minute video clip appropriate for video analysis together with:
 - i. A task for analysis (e.g. counting of *Nephrops* burrows; biotope allocation);
 - ii. A method for analysis;
 - iii. A set of 'correct' answers.

These should be sent to Tim Mackie (NIEA -WMU, 17 Antrim Road, Lisburn, BT29 3HL tim.mackie@doeni.gov.uk Tel: 02892 623062) by **beginning of September 2009**.

Appendices

Appendix 1: Workshop Agenda

| Wednesday 13th May 2009 | |
|---|---|
| 12:30 – 1pm | Registration and Refreshments |
| 1pm | Welcome and Objectives of the Workshop <i>Ian Sotheran – Envision</i> Domestic Arrangements <i>Hester Whyte - Envision</i> |
| Session 1 - The Test So Far <i>Chair: Ian Sotheran, Envision</i> | |
| 1.10pm | Background to the NMBAQC Video Ring Test QA <i>NMBAQC Representative – Matthew Service, AFBI</i> |
| 1.50pm | Development of the NMBAQC Video Ring Test <i>Judy Foster-Smith – Envision</i> |
| 2.30pm | NMBAQC Video Ring Test: Feedback from an Independent Consultancy <i>Alison Bessell - EMU Ltd.</i> |
| 3 – 3.20pm | <i>Tea/Coffee Break</i> |
| Session 2 - Topics for Discussion <i>Chair: Judy Foster-Smith, Envision</i> | |
| 3.20pm | Summary and Issues for 'Breakout' Sessions <i>Ian Sotheran – Envision</i> |
| 3.40pm | Fisheries and Monitoring Issues and Objectives <i>Roger Coggan – CEFAS / Matthew Service, AFBI (TBC)</i> |
| 4.20pm | Mapping and Biodiversity Monitoring Issues and Objectives <i>Rohan Holt - CCW</i> |
| 5pm | <i>End of Workshop Day 1</i> |
| 8pm | Workshop Dinner – GUSTO, Quayside, Newcastle-upon-Tyne |

| Thursday 14th May 2009 | |
|---|---|
| 8.45 - 9.10am | Gather and Refreshments |
| Session 3 - Breakout Groups <i>Chair: Jack Egerton - Envision</i> | |
| 9.10 - 11am A switch B @ 10:05 | <p>A. Fisheries and Monitoring Issues and Objectives Chaired: Roger Coggan – CEFAS <i>Rapporteur: Envision 1</i></p> <p>B. Mapping and Biodiversity Monitoring Issues and Objectives Chaired: Rohan Holt – CCW <i>Rapporteur: Envision 2</i></p> |
| 11 – 11.20am | <i>Tea/Coffee Break</i> |
| Session 4 - Breakout Groups – Reporting <i>Chair: Jack Egerton – Envision</i> | |
| 11.20am – 1pm | <p>A. Fisheries and Monitoring Issues and Objectives <i>Rapporteur: Envision 1</i></p> <p>B. Mapping and Biodiversity Monitoring Issues and Objectives <i>Rapporteur: Envision 2</i></p> |
| 1-2pm | <i>Lunch</i> |
| Session 5 - The Way Forward? <i>Chair: Judy Foster-Smith – Envision</i> | |
| 2pm – close | <p>Requirements for the scheme</p> <ul style="list-style-type: none"> • What Tools and Resources are required? • What is Best Practice for video analysis • How should the Ring Test be marked? • What are the Training and Testing requirements? |
| | <p>Implementation of the Scheme....</p> <ul style="list-style-type: none"> • Training or testing • Number of tests per annum • Turnaround Time • Associated Costs |
| 4pm at latest | Workshop Close |

Appendix 2: Workshop Participants

| Name | Organisation | Address | E-mail |
|----------------------|---------------------------------|--|--|
| Hugh Edwards | NIEA | Klondyke Bld., Cromac Place, Gasworks Business Park, Lower Ormean Road, Belfast | hugh.edwards@doeni.gov.uk |
| Matthew Curtis | CEFAS | Pakefield Road, Lowestoft, NR23 0HT | matthew.curtis@cefass.co.uk |
| Roger Coggan | CEFAS | CEFAS Lab, Pakefield Road, Lowestoft, NR23 0HT | rogger.coggan@cefass.co.uk |
| Emma Verling | JNCC | Monkstone House, City Road, Peterborough, PE1 1JY | emma.verling@jncc.gov.uk |
| Therese Cope | JNCC | Monkstone House, City Road, Peterborough, PE1 1JY | therese.cope@jncc.gov.uk |
| Nigel Thomas | EMU | Head Office, 1 Mill Court, The Sawmills, Durley, Southampton, Harts, SO32 2ES | nigel.thomas@emulimited.com |
| Alison Bessell | EMU | Head Office, 1 Mill Court, The Sawmills, Durley, Southampton, Harts, SO32 2ES | alison.bessell@emulimited.com |
| Doug Stewart | Gardline Environmental | Endeavour House, Admiralty Road, Great Yarmouth, Norfolk, NR30 3NG | doug.stewart@gardline.com |
| Kerri-Louise Sanders | Gardline Environmental | Endeavour House, Admiralty Road, Great Yarmouth, Norfolk, NR30 3NG | kerri-louise.sanders@gardline.com |
| Rohan Holt | CCW | Countryside Council for Wales, Maes-y-Ffynnon, Ffordd Penrhos, Bangor, Gwynedd, LL57 2DN | r.holt@ccw.gov.uk |
| Tom Mercer | ASML | | tommercer@talktalkbusiness.net |
| Harry Goudge | Marine Ecological Solutions Ltd | 17 Dale Street, Menai Bridge, Anglesey, Wales, LL59 5AH | harry@marine-ecosol.com |
| Liz Morris | Marine Ecological Solutions Ltd | 17 Dale Street, Menai Bridge, Anglesey, Wales, LL59 5AH | liz@marine-ecosol.com |

| Name | Organisation | Address | E-mail |
|-----------------------|--------------------------|--|--|
| Geraint Harris-Bryant | Fugro Survey Ltd | Morton Peto Road, Great Yarmouth, Norfolk, NR31 0LT | g.harris_bryant@fugro.com |
| Jamie Dyson | Fugro Survey Ltd | Morton Peto Road, Great Yarmouth, Norfolk, NR31 0LT | j.dyson@fugro.com |
| David Tarrant | Royal Haskoning | 10 Bernard Street, Leith, Edinburgh, EH6 6PP | d.tarrant@royalhaskoning.com |
| Gemma Bedford | Royal Haskoning | 10 Bernard Street, Leith, Edinburgh, EH6 6PP | g.bedford@royalhaskoning.com |
| Paolo Pizzolla | Royal Haskoning (Env.Ag) | Rightwell House, Bretton, Peterborough, PE3 8DW | p.pizzolla@royalhaskoning.com |
| Tim Mackie | NIEA-WMU | 17 Antrim Road, Lisburn, BT29 3HL | tim.mackie@doeni.gov.uk |
| Charlie Lindenbaum | CCW | Maes y Ffynnon, Penrhos Road, Penros Garnedd, Bangor, LL57 2DW | c.lindenbaum@ccw.gov.uk |
| Sarah Peaty | Natural England | Northminster House, Peterborough, PE1 1UA | Sarah.Peaty@naturalengland.org.uk |
| Matthew Service | AFESD | Fisheries & Aquatic Ecosystems Branch, AFESD, Newforge Lane, BELFAST BT9 5PX | Matt.Service@afbini.gov.uk |
| Ian Sotheran | Envision | | ian.sotheran@envision.uk.com |
| Judy Foster-Smith | Envision | | judy.foster-smith@envision.uk.com |
| Jack Egerton | Envision | | jack.egerton@envision.uk.com |
| Hester Whyte | Envision | | hester.whyte@envision.uk.com |

Appendix 3: Resources

Workshop participants were asked to complete a summary list of the resources that they (a) Generate, (b) Use and (c) Would like the lists below show the outcome of this.

(a) Resources that participants generate

- Protocols/recording spreadsheet pro-forma
- Type Biotope Images
- In house compilation of stills
- Specimen stills/screen grabs
- Biotope tagged photos & videos
- (have generated) X 100s of Video transects for biotope abundance (Northumberland, Flamborough, Isle of Wight, Plymouth, Fal & Halford, Lundy, Firth of Lorn, Sunart, Inverness, Firth, Loch Ryan, Pembrokeshire & hand held video in all listed & more)
- Contracted work on extent of subtidal seagrass (density & extent) at various locations incl. Dorset, Gal. Poole.
- CCW: - Towed video/drop video forage from variety of habitats - used for SAC survey and monitoring
- Training footage – annotated video for species identification
- Stills library – habitats, fauna & flora
- Hand held video of quadrats used for noise-mussel bed survey, sponge morphology studies & species monitoring in Mitford Haven
- You tube and Google Oceans MPA layer examples of habitats, species & methods
- Video data from Deep Seas & Offshore surveys (JNCC)
- Video footage, digital stills, geo referencing, associated survey material incl. SSS, multibeam.
- Macrofaunal species lists
- Chemistry-heavy metals, hydrocarbons & particle size analysis
- CTD profiles
- Water column sampling
- 2m scientific beam trawl data

(b) Resources that participants use

- MARLIN
- MCS Guides
- Encyclopaedia of Marine Life
- Any available image based guide
- Habitats
- FSC/WNSOC Guides
- Non-linear video editing suite with frame-by-frame advance
- Bell & Bornes 2001 Sponge Morphology Guide
- Weedseen.co.uk
- CEN standard for hard substrates

- ECSA/Lin Soc keys
- Websites-Bernard Pictons
- Other ringtest samples & images e.g. macroalgae
- British museum algal keys
- Marine Seen – Seaweed website
- MCS photo guides etc.
- WFD procedures (internal EA) & tool technical reports
- Species list from agency own biological databases
- CCW: - Taxonomic guides
- MCS observers guide etc.
- Websites including Marine Seen alga, Bernard Picton's Sponges & habitats online
- Marine Ecological Solutions: Images of Algae & pressings of specimens & Photo library from surveys
- Marine Encyclopaedia website
- Worms website
- Plymouth deep sea species catalogue
- Marine life website
- Seasearch Guides, - on GEL Ringtest 3 feedback

(c) Resources that participants would like

- Video extracted images at different abundance/%cover
- Example SACFOR value images for range of species or species types
- Centralised image/video database
- SOPS – tailored for different applications
- List of internet resources
- CCW's Training Videos
- Scheme for grading quality of video
- Access to a taxonomic expert panel (e.g. For sponges)
- Feature catalogue using controlled vocabulary
- List of species given the appropriate enumeration system to be used for each
- ID'ed biotope clips in archive
- Photos of % cover scales of 0-5, 5-15 etc.
- CCW: - Video examples of habitats/substrate grades
 - Video library – species shots, biotopes
 - Video examples of counting using SACFOR
 - Stills images library – regional variants of species & habitats
- Marine Ecological Solutions: I list of species with the 'general opinion' that you can identify from good quality video. Also a list of species not possible to identify from video – can be used to flag up dubious ID and forcing identification.
- Video library showing good examples of –species moving & - biotopes
- Funding?
- People to do the work

- ID guides for Deep Sea Habitats
- Access to an image library
- Access to standardised procedures & associated training materials
- Calibration/training - counts, % cover, SACFOR, sediment grain size

Appendix 4: Uses of Video

Workshop participants were invited to list existing/potential uses of benthic video. The ensuing list is as follows:

- Debris clearance
- Groundtruthing – for basic habitat mapping
- Seabed form/morphology
- Site Inspection
- SAC identification
- Herring spawning ground ID
- Habitat assessment/annex ID
- Biotope classification
- Archaeological groundtruthing
- Acoustic groundtruthing (sidescan-multibeam)
- Anchor disturbance
- SAC monitoring – stratified random sampling of habitat & SPP
- Surveillance (biotope spotting)
- Habitat mapping/biotope mapping
- Phase 1 or 2 survey
- Fisheries impact (targeting species e.g. *Pentapora* or finding trawl marks etc.)
- E.I.A.
- Geological ground truthing
- Quadrat (hand held) recording (*Modiolus* monitoring/sponge morphology monitoring)
- Subtidal seagrass extent
- Shoot density for WFD
- Seed mussel stock assessment
- Non-native spp. (*Crepidula*/oyster etc.)
- Baited cameras
- Individual spp. distributions for frc & post impact assessment eg. *Ophiothrix* sp. *Aquequipecten*
- Inventory of species to assess physical/biotopic disturbance to seabed
- Fish farm inspection
- Dredge/outfall disposal impacts
- Monitoring capping of toxic dumps
- Litter on seabeds
- Cable route inspections
- Monitoring colonisation of introduced habitats (e.g. Monopoles, scour protection)
- Abundance counts inside & outside MPS's

Appendix 5: Presentations

Slides provided for each of the workshop presentations are provided for reference.