A preliminary assessment of the relationship between angling quality and flow on the Lower Malmesbury Avon

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1. EXECUTIVE SUMMARY

i) This report summarises the attempts made during 1996 and 1997 to relate angling quality to flow on the Lower Malmesbury Avon.

ii) Two primary methods with the potential to provide sufficient data to reflect the true nature of the relationship between flow and angling quality have been identified and tested. These methods were the walkover assessment and the viewing of recorded video footage.

iii) More data using both methods needs to be collected before a sufficiently robust relationship between angling quality and flow can developed.

2. INTRODUCTION

This study is designed to address widespread concerns regarding the impact of abstraction on angling quality on the Lower Malmesbury Avon. The main objective is to assess the impact of flow changes on trout angling quality. The results of this assessment may be used to help set instream flow criteria.

This is an interim report which explores the data collected in both 1996 and 1997 on the Lower Malmesbury Avon. It discusses the merits of the various methods used to collect information on angling quality and makes recommendations for future data collection.

3. METHODS

3.1 1996

Full details of the methods are contained in an earlier report (Ibbotson & Lowans, 1996) but a brief description follows.

In a representative reach below Great Somerford gauging station (grid reference ST 966 832) six transects representing each of six main habitat types were selected for assessment of angling quality. At two different flows (Table 3.1) representatives of the local angling community and independent assessors were invited to the river and asked to assess angling quality at each of the transects on a scale of 0-4 ranging from unfishable (0) through to excellent fishing conditions (4). Only the assessments of angling quality for dry fly fishing have been carried forward for this report.

At the same time the representative reach was habitat mapped providing estimates of the relative proportions of the different habitats in the reach at different flows.

3.2 1997

Feedback from the anglers used in the 1996 survey suggested that they were finding some difficulty in distinguishing angling quality on a scale between 0-4, because this was equivalent to five categories. Some expressed the view that fewer categories would have helped the assessment process. As a result of this it was decided that in future all assessments would be made over a scale of 0-3 ranging from unfishable (0) through to excellent fishing conditions (3).

3.2.1 Walkover assessments

This method was completed at four different flows (Table 3.1). From below the pool at Great Somerford gauging weir to the confluence with the Brinkworth Brook, the main river was habitat mapped and assessed for angling quality on a scale of 0-3 ranging from unfishable (0) through to excellent fishing conditions (3). The method was to start at the top of the section and assess angling quality at a series of transects working in a downstream direction.

Habitat mapping was similar to 1996 but differed in that glides were separated into three velocity categories (slow, medium and fast) rather than simply being categorised as glides. This data could readily be converted into the same habitat types as used in 1996 but it was felt that it would provide more information relevant to angling quality. Depth was measured at the deepest point and visual assessments were made of the velocity type, substrate type, percentages of instream and outstream cover and habitat type (see Table 1, Ibbotson & Lowans, 1996 for definition of habitat types). Assessments were made each time the quality of angling changed or every 50 paces whichever was the shortest distance.

Over the four flows, assessments of angling quality were made at between 52 and 69 transects on each visit. All of this work was completed by only one person Anton Ibbotson who is experienced at both habitat mapping and fly fishing for trout. A description of the procedure for doing this is given in Appendix A.

Table 3.1. Summary of data collected for angler assessment study on the Lower Malmesbury Avon.

Date	METHOD			
	Panel of angler site visits to assess transects	Walkover assessment of whole reach by Anton Ibbotson	Video footage	Daily Mean Flow (cumecs) at Great Somerford Gauging Station
13-14/09/96	XX			0.370
23-26/09/96	XX			0.324
15/05/97		XX	XX	0.766
13/06/97		XX		0.597
05/07/97		XX	XX	0.555
14/07/97		XX	XX	0.396

3.2.2 Video footage

Coinciding with three of the walkover assessments video records were made of six different transects within the representative reach (Fig. 3.1). Attempts were made to obtain a video record on the fourth visit but this was abandoned because of rain. All videos were recorded with an SVHS camera, with a light polarising filter, when the sun was not hidden behind clouds to maximise the quality of the film record. The span of each shot was kept consistent between times and a ranging pole was placed in the river within the shot to give it perspective.

Several shots of each transect were recorded and the best one selected by editing for eventual assessment. The procedure for recording the video footage is included in Appendix A.

A preliminary and experimental assessment was made of the angling quality from the video footage using assessors that would not be used in the final assessment. Those present at the preliminary assessment were David Bird (Fishery Scientist, EA), Robert Grew (Hydrologist, EA), Simon Steel (Fisheries Inspector, EA) and Anton Ibbotson (Fishery Scientist, IFE). All assessors were asked to independently complete a proforma judging the angling quality of each transect from the video footage on a scale of 0-3 representing unfishable conditions (0) through to excellent conditions (3). For a full description of the video viewing procedure see Appendix A.

The results from all the methods used were analysed, compared and presented to draw preliminary conclusions and provide recommendations for future data collection.

Figure 3.1 Schematic diagram of representative reach on the Lower Malmesbury Avon, below Great Somerford Gauging Station, showing location of video transects.

4. RESULTS

Over the two years of study there have been three methodological attempts to relate angling quality to river flow on the Lower Malmesbury Avon. The method used in 1996 is not directly comparable to the methods used in 1997 because the scale for assessment (i.e. 0-4) was different for those used in 1997 (i.e. 0-3). However all three methods demonstrate positive relationships between flow and angling quality (Fig. 4.1), although none of the relationships are significant at the 5% level because the number of data points is low. The assessments made by Anton Ibbotson over the whole reach were significant at the 10% level and flow explained 85% of the variation in angling quality in this case (Fig. 4.1a).

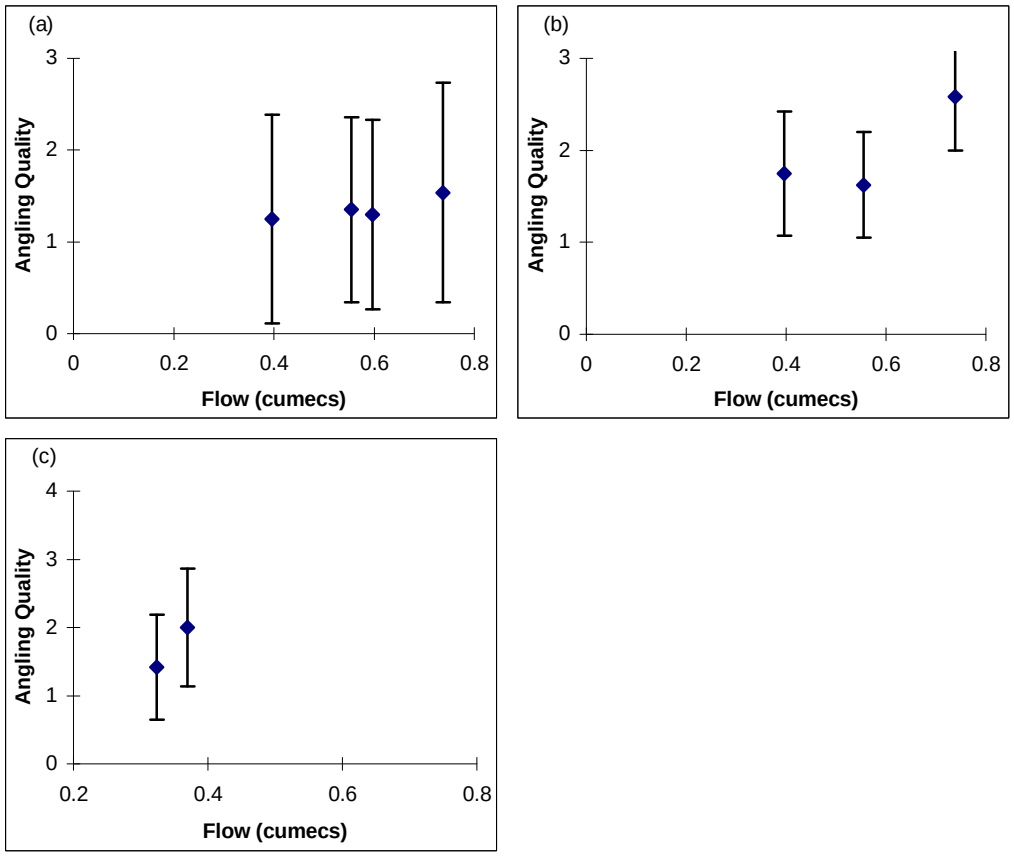

Figure 4.1. The relationship between angling quality (a:- as assessed by Anton Ibbotson over whole reach; b:- as assessed by 1997 video footage; c:- as assessed by angling panel visiting site in 1996) and flow (cumecs) (error bars represent standard deviation).

Using the video footage the highest flow gave the highest angling quality score, giving the appearance of increasing angling quality with increasing flow (Fig. 4.1b). This relationship generally held good with each of the individual video transects, with the possible exception of transect 1 where the highest score was given for the lowest and highest flow (Fig. 4.2).

Both the walkover assessments and video footage completed in 1997 were collected at the same time but because both methodologies result in different quantitative assessments they are not easily comparable. However, the two methods used in 1997 were plotted against one another (Fig. 4.3) to see if they were consistent. No obvious consistency was observed.

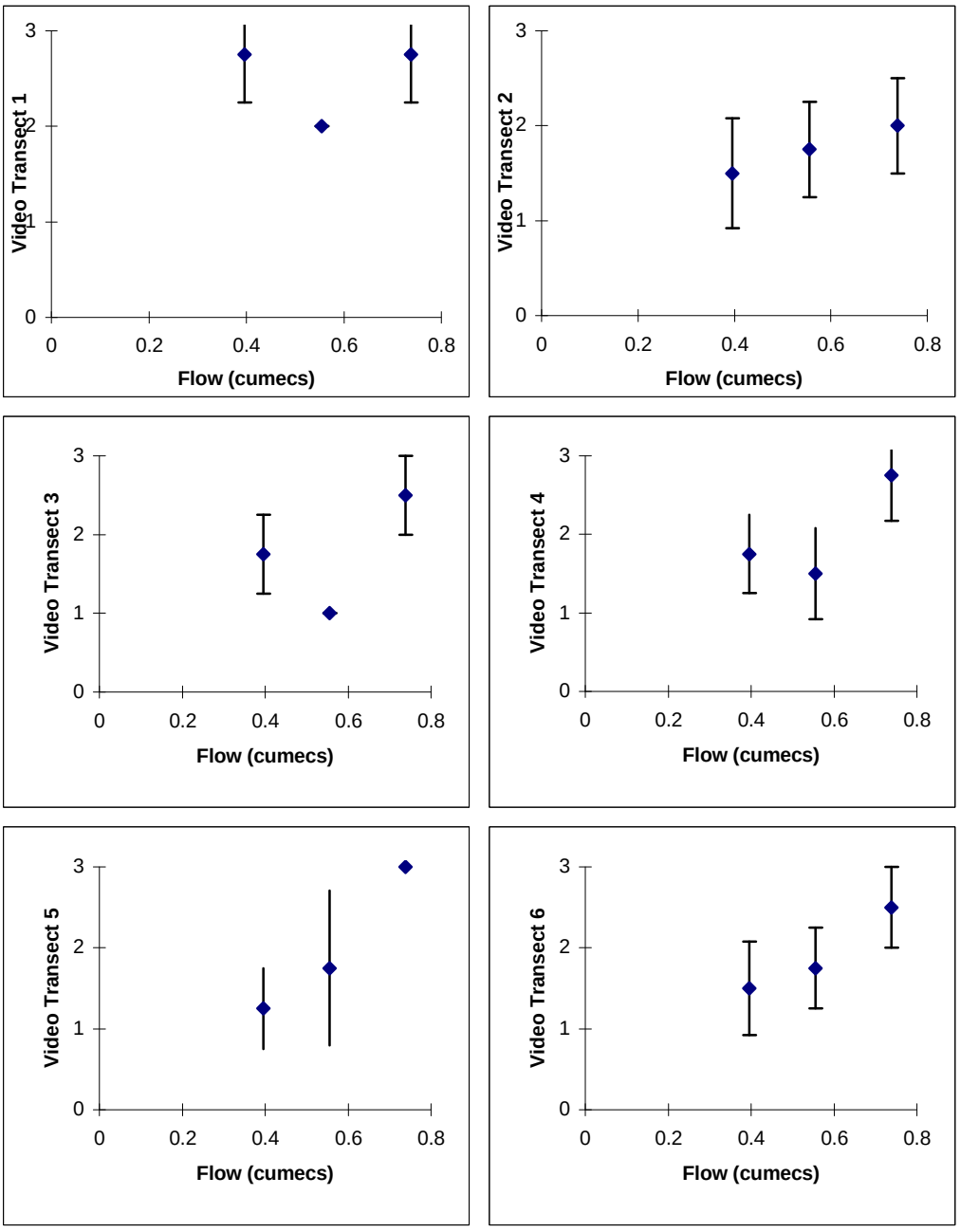

Figure 4.2. The relationship between angling quality and flow on each of 6 video transects (error bars represent standard deviation).

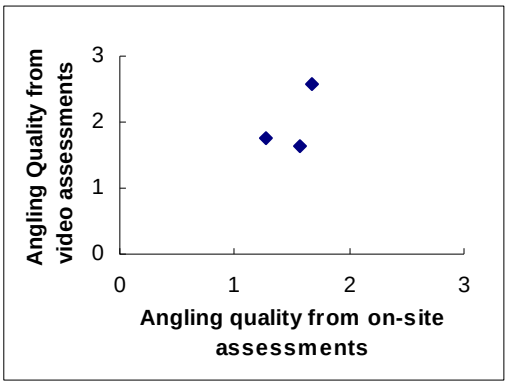

Figure 4.3. Comparisons of angling quality assessed from video footage and walkover assessment.

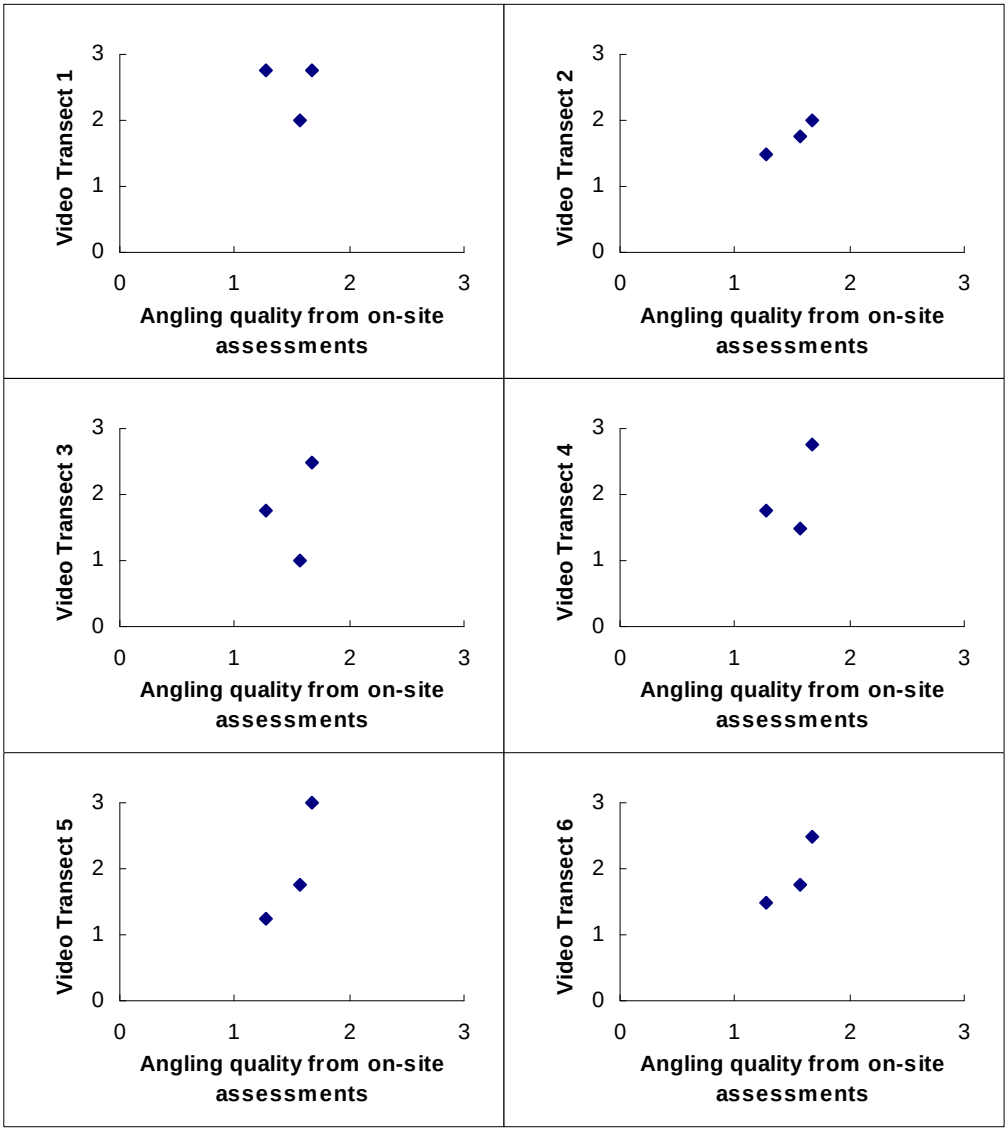

Figure 4.4. Comparisons of angling quality assessed from each of six video transects and walkover assessment made on three different occasions.

The relationship between the assessment of angling quality for individual videos and the walkover assessment showed that some of the video sites, notably 1, 3 and 4 showed a very poor link with the walkover assessments (Fig. 4.4).

Four assessors were used for viewing the videos and comparisons of their individual scores and those of the walkover assessments showed that only assessor 3 was consistent with the walkover assessments (Fig. 4.5). All the other assessors scored the medium flow low.

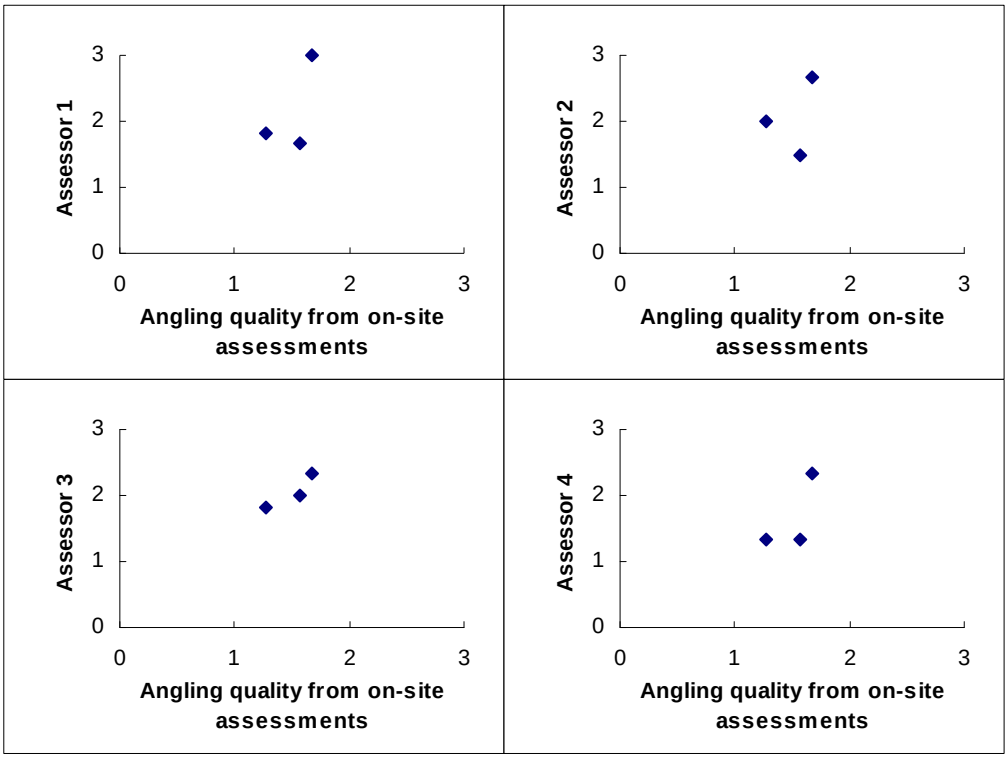

Figure 4.5. Comparisons of angling quality assessed by individual assessors from six video transects and on site assessment.

5. DISCUSSION

The consistent relationship between flow and angling quality on the Lower Malmesbury Avon through three methods is an encouraging aspect of this study. However, not enough data points have been collected by any of the methods to allow any firm conclusions about the relationship between flow and angling quality to be drawn.

5.1 Walkover assessment of angling quality

This was the method which was most consistent at showing a positive relationship between angling quality and flow. Although this is encouraging it is important to realise that it only represents the opinion of one person. In isolation such data could not be used to help set flows.

However, despite the walkover assessment being completed by the same person, Anton Ibbotson, it was done using standard practices for habitat mapping which include actual measures of depth, for example. This would lead one to think that the angling assessments made by this method were a good reflection of true angling conditions at the time despite the lack of replication.

If assessment of video footage becomes the prime method for quantifying angling quality it might be argued by some, that the walkover assessments are not necessary, but it is important that it is continued so that at the very least the output from the video footage can be compared with another method of assessment to achieve some level of validation.

If this method is to be used in a water resource management process it will need to be repeated by a specially designated panel of anglers at several flows. It is noted that Simon Steele (EA Fishery Inspector) is available to do this work in the future, but a number of local anglers should also be involved to help.

These anglers would not need to come on site all on the same day but could do the assessment when they were free. If they were given a target number of times to visit the river (e.g. 10 occasions between May and September) this could provide a statistically robust set of data. This would solve the logistical problems experienced in 1996 when all the anglers were invited to give assessments on the same day.

5.2 Assessments of angling quality from video footage

Assessment of angling quality from the three sets of video footage taken in 1997 showed a less consistent relationship with flow, with angling quality at the medium flow falling below angling quality for the lowest flow. This resulted because of the four assessors used three scored the medium flow low.

This was a discouraging result for use of this method in assessing angling quality, so the panel was reconvened at a later date and the assessment process was repeated for

the same video footage. Afterwards, individual members of the panel were asked to discuss the reasoning behind their scores on each occasion.

The total scores which were obtained from the two assessments of the same video footage were clearly similar (Table 5.1). This demonstrates that assessment of angling quality from the video medium by a panel is consistent.

However, the medium flow was again marked low at the second convening of the panel, although slightly higher than the low flow. When the videos were viewed and discussed after the assessment it became apparent that the quality of video footage from the medium flow was poor. This resulted from a colour imbalance in the recording giving a brown tinge to the river. All assessors agreed that this had been the cause of their low score, which was therefore independent of the flow. This video footage needs to be omitted from any future assessment.

Table 5.1. Comparison of angling quality assessed on two occasions from three sets of video footage.

	1st Assessment score	2nd Assessment score
High flow	62	60
Medium flow	39	37
Low flow	42	36

This experience highlights a potential problem with using video footage, in that assessors may be unduly biased by video quality rather than angling quality. This will require an independent assessment of each set of video footage, so that those with markedly different video quality can be removed from use in this study. There are already protocols in the procedure for collecting video footage for reducing the risk of variable video footage quality. For example, video footage is only collected in bright light conditions.

During the discussion amongst assessors it became apparent that an individual's assessment might be biased by previous video footage that had been observed. In other words, a transect with medium angling quality viewed immediately after one with high angling quality may result in a low rather than a medium score. To alleviate the risk of this occurring all assessors should be given a considerable break between viewing transects at different flows. Additionally, the order of flow at which the video footage is shown should be randomised and repeats of each flow shown without the assessors knowledge.

5.3 Comparison between walkover and video assessments.

The poor relationship between the assessments made on site by Anton Ibbotson and the assessments made with the video footage is at first site a worrying aspect of the work. This could result from any one of the following four reasons:

1) The video footage is not representative of the angling conditions

2) The personnel used for the video assessments were not experienced at dry fly fishing and thus not qualified to assess angling quality

3) The walkover assessments made by Anton Ibbotson are not representative of the angling conditions

4) Both methods of assessment generate data that is not representative of the angling conditions

This poor relationship can be explained solely by the medium flow being marked low with the video footage, and as already discussed this appeared to result from the poor quality of the footage rather than from poor angling quality.

This problem may be compounded because the assessors used for the video footage have not all been experienced fly fishermen and those individuals may be making assessments from irrelevant cues. When the genuine assessments are being made the panel of assessors needs to be chosen carefully.

The walkover assessments made by Anton Ibbotson resulted in lower scores than the video assessments. Partly this may reflect the biggest disadvantage of this method, that is, it being the result of only one person's opinion. However, it is much more likely to be due to the selection of transects for the video footage. These transects were selected on the basis that they were fishable reaches that were likely to have angling quality that would vary with flow. As such they do not represent all of the habitat found on the Lower Malmesbury Avon and, in particular, not the unfishable reaches. Conversely, the walkover assessment covers the whole section including the less fishable reaches and thus the average scores are lower.

5.4 Why does angling quality change with flow?

The main hypothesis behind this study is that angling quality alters with flow. Angling quality could be measured in many different ways (e.g. number of fish caught per unit effort of angling; number of anglers visiting per unit time; angler opinion; number of fish present; behaviour of fish). In this study, it is angler opinion that is being used as the measure. To develop such a hypothesis it is worthy to try and explain why angling quality might change with flow.

Values for angling quality from the walkover assessments showed a strong correlation with habitat type in the river at the time of the assessment. The best relationship was with the proportion of deep glide (Fig. 5.1). Deep glide explained 90.3% ($p<0.05$) of the variation in angling quality.

In turn, the proportions of different habitat type in the river changes with flow. This is to be expected with shallow water becoming deeper and slow water flowing faster as water is added to the river.

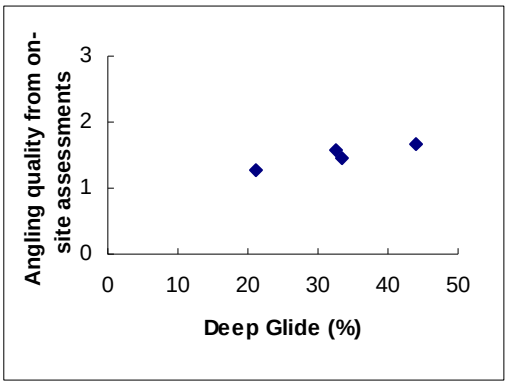

Figure 5.1. Changes in angling quality with changes in the percentage of deep glide.

The strongest relationship between habitat type and flow was observed with deep glide (Fig. 5.2), where a quadratic function of flow explains 95.8% (p=0.004) of the proportion of deep glide over the flow range experienced (data from 1996 and 1997 habitat mapping was used.

Thus it appears that deep glide is a high quality habitat to the dry fly fisherman and quality over the whole reach is influenced by the proportion of this habitat present. Flow has it's influence on angling quality by altering the proportion of this habitat available. However, it is worth making the point that whilst deep glide may be an excellent habitat for fisherman it will not necessarily be a suitable habitat for all the life stages of all the fish that live in that river. Slow flowing reaches, for example, are important for the juvenile stages of many of the species present in the Lower Malmesbury Avon.

It would therefore be a mistake, ecologically, to increase flow until the whole river became deep glide, although from the quadratic relationship (Fig. 5.2) it would appear that the impact on habitat of increasing flow diminishes at higher flows.

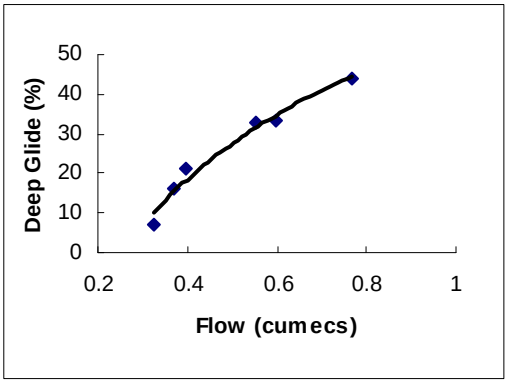

Figure 5.2. Changes in the percentage of deep glide as a function of flow, including data from 1996 and 1997 habitat mapping.

5.5 Recommendations for future surveys

- The walkover assessments should be repeated with at least 2 expert fishermen and 2 local fishermen with a target of ten visits each.
- More video footage should be obtained covering a wide variety of flows.
- In future pilot assessments should only involve the use of expert fly fishermen.

6. REFERENCES

Ibbotson, A.T. & L. Lowans 1996 The use of angling quality criteria for setting flows in the Malmesbury Avon catchment: Data for medium and low flows. Report to EA South West Region, 54pp.

APPENDIX A

PROTOCOLS FOR ASSESSING ANGLING QUALITY

Procedure for walkover angling assessment.

1. Start immediately below pool below Great Somerford gauging weir and note this as transect 1.

2. Make assessment of dominant habitat type (see sheet) on transect.

3. Make assessment of dominant substrate type (see sheet) on transect.

4. Estimate the percentage of river bed covered by both instream and outstream cover on transect.

5. Make assessment of fishability from that position for both dry fly (upstream) trout fishing and wet fly (downstream) trout fishing on a scale of 0-3, where 0 = unfishable, 1 = poor, 2 = good and 3 = excellent.

6. Move in a downstream direction counting paces as you walk. As soon as habitat type or fishability changes stop. Make a note of the number of paces from transect 1 in the box next to transect number, enter number 2 in box below transect number 1 and repeat process.

7. Stop at confluence with Brinkworth Brook.

Procedure for recording video footage

1. Visits should only be made during conditions of bright weather and when flows are at a suitable level. This requires liaison with both EA hydrology staff and the Meteorological Office.

2. A preliminary visit needs to be made where individual transects should be chosen for recording videos. The following criteria should determine the location of these transects.

i) The quality of the video that can be obtained, that is high banks are easier to take video footage from than places level with the river bed.

ii) The suitability of the transect for fly fishing, for example, do not choose a place near a sewage outfall or a cattle drink.

iii) the potential of the fishability to change with flow levels, for example, do not choose a place immediately above a weir where the water will remain the same depth and have the same velocity over wide range of flows.

iv) transects should represent the habitat available in the fishery under study.

3 Once chosen the video camera should be set up, on its tripod and several preliminary shots should be taken and viewed with the view finder on the camera. Once the operator is content with the span of the transect and the positioning of the camera, the exact location of the camera should be marked with a peg.

4. When videos for angling assessment are to be taken a ranging pole should be placed in the river in the shot to give it perspective. Several shots should be taken over a period of 5-10 minutes to ensure that there will be a least one high quality.

5. It is recommended that the camera should be focussed on the substrate and use a light polarising filter to reduce glare and reflection. Filming should be done on bright days only. The span should not be longer than 10-15 m of river bank otherwise there is a risk of too much varying habitat being incorporated in the video shot.

Procedure for viewing videos for assessment.

1. Prior to viewing the videos should be edited and placed in order so that the assessor can view all the transects shot at one particular flow in sequence. Repeats of sequences should also be made.

2 Assessors should be asked:-

i) to view each transect in isolation from other transects

ii) after viewing each transect, to place a tick in box corresponding to the quality of the transect for dry fly angling, where 0 = unfishable, 1 = poor, 2 = good and 3 = excellent.

3. Before the assessment the assessor should be told:-

i) the objectives of the study

ii) that he is to imagine he is standing in the same position as the video camera and that his assessment should be of what the angling conditions would be like from that position and that position only.

iii) that there is no right or wrong answer to the assessments and that it is not the assessor that is being assessed

iv) that the ranging pole is there to give perspective and to help him with this a ranging pole will be placed at his side for reference.

v) that he may ask to see shots of each transect as many times as he likes before making the assessment.

4. At the assessment:-

i) the assessor will be kept separate from other assessors.

ii) each viewing of transects at one flow will be separated from viewings at other flows by a break of half an hour filled with a mentally stimulating activity such as viewing an activity of interest.

iii) each assessment will be carried out in the same room with the same seating arrangements.

iv) a ranging pole will be supplied to provide visual comparisons with the ranging pole in the river.

v) repeats of some of the footage should be shown but the assessor should not be aware of this.

APPENDIX B

RAW DATA FOR WALKOVER ASSESSMENTS AND VIDEO FOOTAGE SCORES

APPENDIX C

SCHEMATIC DIAGRAMS OF HABITAT TYPE AND WALKOVER ASSESSMENT

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