



DCM TECHNICAL SERVICES INC
PROVIDING MEASUREMENT & MAPPING SOLUTIONS

January 23, 2006

Attention : Mr. Rich Delaney
World Record Muskie Alliance
11607 Lucas Road
Woodstock, IL

Dear Mr. Delaney,

In response to the National Fresh Water Fishing Hall of Fame's (NFWFHF) January 13, 2006 review of the World Record Muskie Alliance's (WRMA) record review submission, containing two reports authored by DCM Technical Services Inc., the following text contains comments and concerns that I have with the NFWFHF written review. Near the beginning of the review, the NFWFHF indicate that "one of the most basic principles of the scientific method (is) that of **conducting a control experiment**". This really is not the case and, as indicated on Wikipedia.com, the scientific method involves the development of theories and "Predictions from these theories that can be reproducibly tested by experiment are the basis for developing new technology". Reproducibility of the method is required and the basis for "new technology". Photogrammetry and the specific software used to complete the analysis, PhotoModeler Pro v5, are not new technology and the methods used have been validated in many previous experiments negating the need to re-validate a commonly accepted procedure. Photogrammetry has been used since the Civil War and all aspects of the methods used in the DCM analysis have been validated many times in countless peer reviewed journals. The software that was used in this instance to complete these photogrammetric analyses, has been commercially available since 1993 and also has been validated and the subject of many peer reviewed publications. Photogrammetry is merely the science of making measurements from photographs. The specific type of object (be it land masses, mechanical parts, vehicles or fish) being measured in the photographs is irrelevant and the already validated science of photogrammetry does not need to be re-validated to be applied to measure a fish. In actuality, the analysis completed by DCM would be better classified as scientific analysis rather than an experiment since the science has already been proven and the procedure was purely a measurement using validated methods. Further down in the NFWFHF review in section IV, it is indicated the DCM used "a software program that is primarily used in automobile accident reconstruction cases". This is also incorrect and was indicated as such to the NFWFHF in their series of questions to DCM. DCM explicitly stated, and referred them to the PhotoModeler web site for verification, that the software is photogrammetric software written to take measurement from photographs. It is used in the accident reconstruction industry but also extensively used by many professions, including among others, military, archaeology, architectural and industrial measurement.

The NFWFHF review also questions DCM's proper use of the software and basic photogrammetric principles. Although the WRMA and NFWFHF are both aware of my credentials I will quickly review them. DCM is an authorized services firm for PhotoModeler and has been since 1998. DCM also instructs all of the PhotoModeler authorized courses offered worldwide. Most recently, DCM completed training on photogrammetry and the application of PhotoModeler to the Massachusetts State Patrol Collision Reconstructionist Unit, state wide. Dan Mills, president and owner of DCM

has an undergraduate degree in Survey Engineering with extensive course work on all aspects of photogrammetry. Dan Mills has also completed graduate level photogrammetry courses and has been author on various peer reviewed, technical publications. DCM is quite qualified to complete any and all forms of photogrammetric analysis, including the application of PhotoModeler.

The NFWFHF review included comments from two professors that the photographs used in the 1949 had two vanishing points but the “*right vanishing point is considerably weak*”. While the right vanishing point is not as strong as the left, a solution was obtainable which is evidenced, among other analysis methods, by the quoted residuals included in the DCM report. Residuals are a measure of accuracy in a photogrammetric solution and it does not appear that either of the professors were provided with the DCM report in its entirety for comment or even would have been qualified to comment on its entire contents. The “80 assumptions” used by DCM that were quoted in the NFWFHF review were, as indicated in their review, merely marked points. Their indication that they are assumptions and the use of my partial quote supporting it are incorrect. They would be measurement points but that would be tantamount to saying that reading a measured point off of a measuring tape is an assumption. The assumption included in the DCM report and relating to the 1949 fresh fish analysis was that the angler’s bent right arm was at maximum, 84” above the ground. The remainder of the analysis was either marked points or measurement from those points. It should be noted at this point that the marked point on the ground that was found to be directly below the 1949 fish and the suspension point on the oar was derived using the software. While the NFWFHF argues that the software could not be used to reliably derive a perspective corrected measurement of the fish, the NFWFHF does feel that the software solved ground point is accurate enough to use in their “same plane/direct scaling” method.

This “same plane/direct scaling” method described by the NFWFHF, has apparently been proven using their control test and is quoted as being “long been utilized in the field of photogrammetry as a means of determining distances in photos”. This not a correct statement for a multitude of reasons. Physical proof of the flaws in this method as applied by the NFWFHF is included later in this report. Firstly, this method is not utilized in any form of reliable photogrammetry. After James Harris of Harris Technical viewed the information that the NFWFHF attributed to him, he indicated that what he said was taken out of context and not supporting their “same plane/direct scaling” method. He also added “I never did see the photo in question, declined to even look at it to perform any type of analysis as it is beyond the scope of what I do anyway, and referred them to Eos Systems for further possible assistance”. It is also of interest that Mr. Harris will be a student in the PhotoModeler course that I will be teaching from January 24-26, 2006 in Florida. The only way that this method will yield moderately accurate results would be if it was “same plane/**same film plane**/direct scaling”, meaning that the camera film plane must be at the same angle as the plane being measured. This is supported by statements in a letter from Professor Goldfeld to the NFWFHF, included as Figure 1. Professor Goldfeld makes the distinction that the “same plane/direct scaling” computations are only valid if the camera has negligible tilt relative to the ground.

John Detloff
President
National Fresh Water Fishing Hall of Fame
10360 Hall of Fame Drive
Hayward, WI 54843

January 7, 2005

Dear Mr. Detloff,

You have asked me estimate the length of the fish in the control photo you sent me on January 4, 2006. As I explained in an earlier e-mail, the computations I sent you in my earlier letter of December 14, 2005 are only valid if the camera is aimed at the fish in a plane parallel to the ground, i.e. the camera has negligible tilt from the ground. Under this assumption the length of the fish can be obtained by a ratio computation independent of the position of the photographer. In the case of the control photo, I obtain the following:

ESTIMATES:

Assume the camera was not tilted with respect to the ground when the photo was taken. With the indicated distance between the top edge of the subject's fingers and the floor directly beneath it being known to range between 80 inches and 82 inches, and given that they are in the same plane as the entire length of the mounted fish, my calculations show that the length of the visible portion of the mounted fish in the control photo has a range between 50.84 inches 52.11 and inches.

Figure 1

It would appear that he indicates this since the fish is hanging vertically and there is the requirement for the fish plane and the film plane to be parallel. This is also supported in Professor Goldfeld's diagram that shows the film plane (p-pp) and the fish plane (f-ff) being parallel. The control test completed by the NFWFHF had the model muskie hanging vertically and the camera was held approximately level, making the two planes parallel. This is why the control measurements were relatively accurate and reproducible by both of the mathematics professors. In the case of the angler with the fresh muskie hanging from an oar, the camera was located lower on the hill and pointing up towards the muskie. This was even indicated in Professor Goldfeld's opening paragraph in his Dec 14th, 2005 letter to the NFWFHF where he stated "I shall further assume that the photographer is directly in front of the fish, probably crouching down and aiming the camera up at an angle". Given the need for object plane and film plane to be parallel to each other for even moderately accurate results to be possible, it is unknown why Professor Goldfeld would have proceeded with the calculation when he identified in his opening paragraph that the camera was located lower than the muskie and looking up at it. It should also be noted that the lines that the NFWFHF provided to the professors to evaluate were incorrectly represented to them. As indicated by DCM to the NFWFHF, the + sign, located at the top left of the marked point was the measurement point. This results in a measurement interval of A-BB, not the A-AA or B-BB that the NFWFHF asked to be evaluated by the professors.

To illustrate the effects of a tilt between the film plane and object plane, a 2x6 board was photographed with markings of known measurement on it and with a camera vantage point located lower than it and photographing it up a hill. A board was stood level in a stand (note that the board was vertical but a slight slant in the ground surface makes it laterally angled as it exits the stand) and photographs taken at different locations and angles to the board. The board was 84" in length from the top edge down to the black horizontal line. Also marked on the board were two red lines that were 53.6" apart. Included as Figure 2a and 2b are two of those photographs. No changes in position were made to the board and any of the lines between photographs. The only change was the location and angle of the camera. The board was straight and all of the lines, with known dimensions, were located on the same plane. Using the methods outlined in the NFWFHF report, measurements were taken from the photographs using this "same plane/direct scale" method with wildly varying results. In Figure 2a the red lines, which

had a true distance of 53.6" between them, were calculated to be 60.3" and the same lines in Figure 2b were calculated to be 58.5" apart. Changes in angle of the camera will continue to change this measurement. The fact that the professors calculated a length that was greater than the DCM photogrammetrically calculated length was to be expected given the visually obvious perspective that was present on the two photographs used in the DCM analysis of the 1949 fish. The ruler experiment that the NFWFHF included in their report did appear to show the board slightly away from the wall at the bottom but the example included in Figures 2a and 2b easily demonstrates that a slant does in fact have an effect on the overall measurement. This is merely another "control experiment" to show why exactly this "same plane/direct scale" method is not used to derive accurate measurements and why true projective photogrammetry is actually used to derive measurement from photographs. As stated, the image of the person holding the model fish was taken at a more straight on angle and resulted in more consistent measurements. Movement of the camera that resulted in a vertical tilt of the film plane would also have made the values erroneous in that experiment as well.

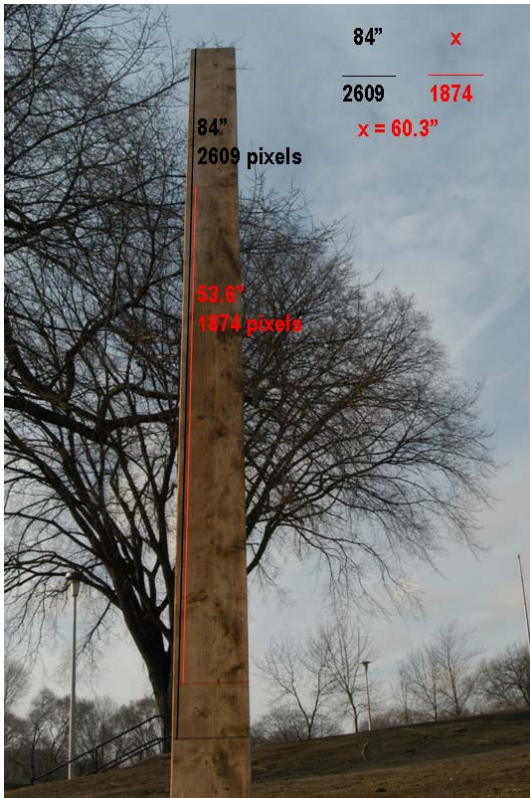


Figure 2a

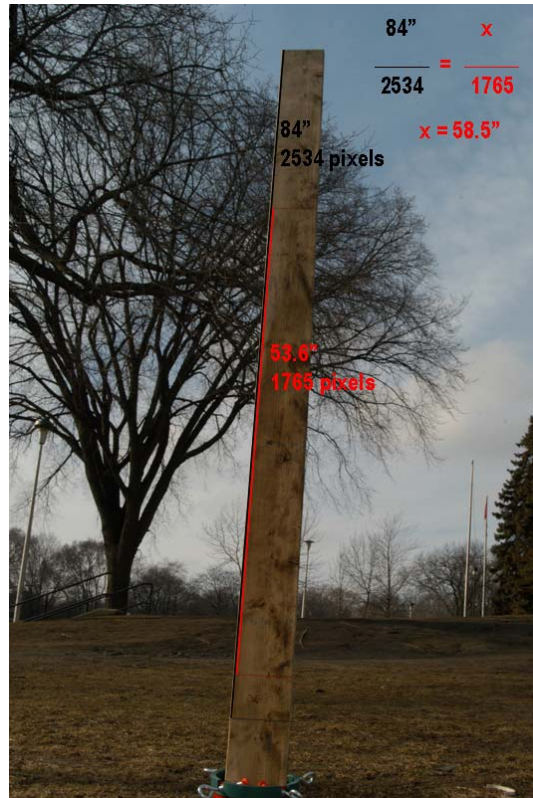


Figure 2b

As a third example of measurement, the NFWFHF included measurements derived from the "new photo". This photograph was one that has been noticeably modified by, at the very least, the removal of the background. Given this substantial modification there seems no reasonable way to assure that the photograph has not had other modifications completed on it. The photo was provided to Professor Gallian (for an unknown reason, an analysis was not presented from Professor Goldfeld for this image) with what was marked as "Bottom of Angler's Heal" (should read "heel"). While the use of this photograph was inappropriate due to its modification and the fact that an unquantifiable perspective was present and only an absolute maximum length could

be determined, the area marked as “Bottom of Angler’s Heal” is incorrect. There is no portion of the angler’s left boot visible and only pant leg that can be discerned in that photograph. Any underestimation in bottom of the angler’s foot or the top of his head would result in a shortening of the resulting maximum length calculation of the muskie.

Relating to the comparative analysis of the fresh and mounted versions of both fish that DCM evaluated, it was not the placement of the fins that were questioned. While the profile of each fish was overlaid the concern identified was the percentage difference in overall size that was identified to the WRMA as a concern.

I hope this answers your questions about major concerns that I have with the NFWFHF report and analysis of my report. The DCM report was subjected to an independent peer review. The NFWFHF analysis appears to have been completed in-house by members of the NFWFHF using partial analysis from other sources. During the series of questions that the NFWFHF e-mailed me with on numerous occasions, I had indicated that they would be best served by getting an independent peer review completed by a qualified photogrammetrist of the DCM report if they had any concerns. Unfortunately they did not choose to do that and instead pieced together comments, at least some of them incorrectly, from other individuals and decided how they would apply to the DCM report. I do not see how this can be proof of “poor science” or invalid results and still submit that my professional analysis is valid and has been supported with your independent peer review.

Sincerely,

A handwritten signature in black ink, appearing to read "Dan Mills", written in a cursive style.

Dan Mills
DCM Technical Services Inc.