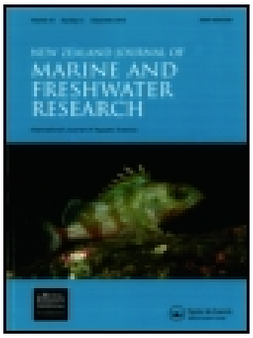

New Zealand Journal of Marine and Freshwater Research

ISSN: 0028-8330 (Print) 1175-8805 (Online) Journal homepage: http://www.tandfonline.com/loi/tnzm20

An improved fish measuring board

C. S. Woods

To cite this article: C. S. Woods (1968) An improved fish measuring board, New Zealand Journal of Marine and Freshwater Research, 2:4, 678-683, DOI: 10.1080/00288330.1968.9515264

To link to this article: https://doi.org/10.1080/00288330.1968.9515264

Published online: 30 Mar 2010.

AN IMPROVED FISH MEASURING BOARD

C. S. WOODS

Department of Zoology, University of Canterbury*

(*Received for publication 9 February 1968*)

SUMMARY

A description is given of a fish measuring board that permits easy and rapid length measurements to be made without number bias.

INTRODUCTION

Measurements of length are subject to many forms of error, and one important category of error is number bias. Personal idiosyncrasies, such as "preferring sevens" (27, 37, etc.) at the expense of "sixes" or "eights", may be of short duration. The selection of an unduly high proportion of even terminal digits or of "tens" and "fives" is more general. This may be unimportant, especially if the measurements are made to a greater accuracy than is required for analyses, but it can waste time. The awareness that such complications can occur may lead the conscientious operator to make other more obscure errors involving number bias.

Allen and Cunningham (1957, p. 34) record a bias toward even numbers in the length frequencies of trout recorded by field officers who had to record to the nearest inch. One colleague was surprised to find that his length records, taken to the nearest millimetre, were so strongly biased that 84% of the measurements tested were at even- or half-centimetre values (Table 1, No. 1). This sample contained four subsamples and the bias was consistent in each. The writer's records of length frequencies for small eels, measured with all possible "accuracy" along a scale marked in millimetre divisions, had the "tens" over-represented by a factor of about two (Table 1, No. 2). Vernier calipers as usually used in taxonomic work can be read with little bias. Another colleague took measurements with simple Vernier calipers in Antarctic field conditions with noteworthy precision (Table 1, No. 3 and 4).

Figures 1 and 2 show the design and dimensions of a measuring board used by the writer during a systematic study of some small fishes for which some 20,000 accurate length measurements, a few down to about 1 mm, were made. This board is a modification of one designed earlier

---

*Present address: Department of Zoology, University of Manitoba, Winnipeg, Canada.

by the writer for use under field conditions. Fork lengths of over 10,000 trout, in the size range 20–70 mm, were recorded to the nearest 0.5 mm at a rate of several per minute (Woods 1964, p. 180). The frequencies of length measurements, when altered to 1.0 mm intervals, lacked any bias toward significant numbers. This early model was small and convenient to operate with one hand. Except that it was smaller, with a rail in place of the runner on which the moving arm was mounted, it was similar in basic design to the model described here for laboratory use.

TABLE 1—Values and frequencies of terminal digits from six series of recordings of length measurements showing various degrees of bias

Ref. No.	% Numbers of recordings of length measurements ending in each of the following digits										Total No. of recordings
	0	1	2	3	4	5	6	7	8	9	
1	44	2	3	2	0	40	0	3	7	0	334
2	18	8	7	11	9	13	7	10	11	7	711
3	14	5	8	13	11	8	9	6	16	10	122
4	19	10	8	14	13	7	11	6	10	1	83
5	19	8	8	10	10	7	10	10	11	7	849
6	11	9	10	11	10	9	10	10	10	10	1192

DESCRIPTION

The measuring board described here and illustrated in Figs. 1 and 2 is designed to be read to an accuracy of 1.0 mm or 0.1 mm as required. As constructed, it consists of a board compounded from three sheets of Perspex*. The base (A) is of black Perspex, which with suitable lighting, gives a satisfactory mirror surface. The middle layer (B) is of clear, thick Perspex which has lines and numbers etched on its upper surface. Included are two oblique lines 100 mm apart and a series of lines 5 mm apart at right angles to the long axis of the board. Each of these has a number representing millimetre values of from 10 to 130 at its distal end. These etchings are shielded by the thin transparent upper layer of Perspex (C). Thin Perspex strips bond these sheets solidly together along their outer edges. One of these strips (D), along the edge furthest from the operator, is elevated above the level of the board to act as a runner for the moving arm (E). The most efficient main (proximal) runner, which allows the moving arm to slide very

*Perspex = Plexiglass = Methyl methacrylate.

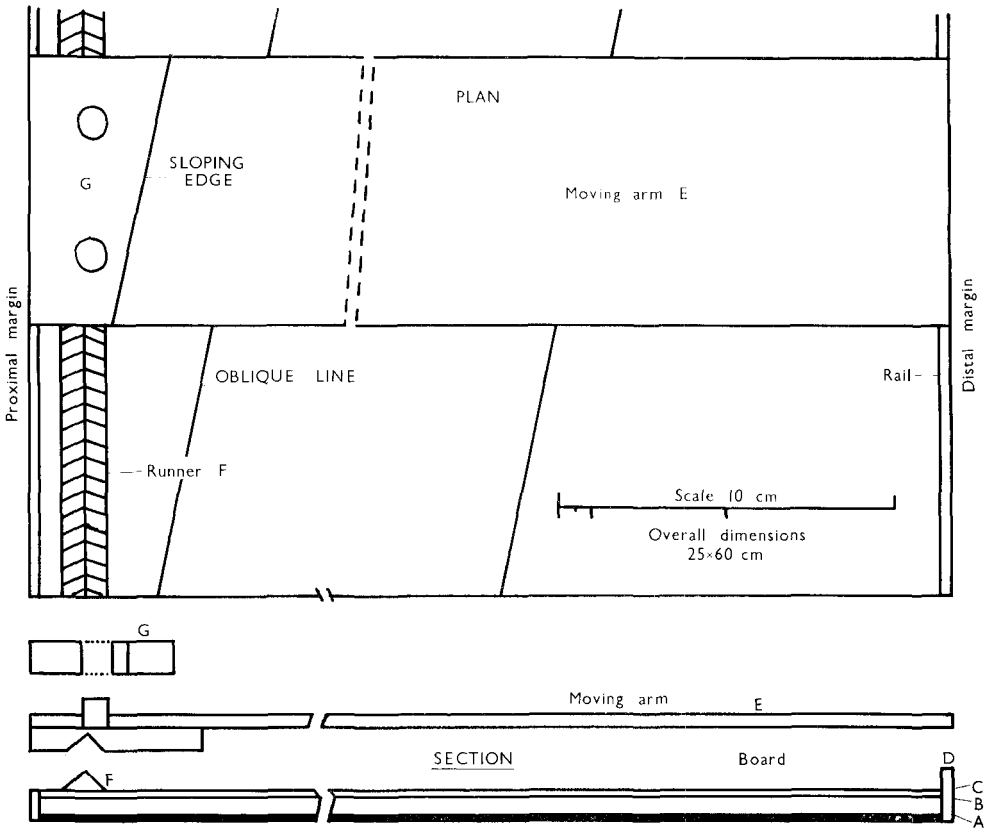

FIG. 1—Plan and section of right portion of measuring board and moving arm.

freely, was found to be a rod with an inverted-V section. Such a rod (F) is bonded to the base close to the edge nearest the operator. The moving arm, of clear Perspex, has an inverted-V groove beneath its proximal end which accommodates the rod on the base and permits the arm to be moved along the length of the board. A piece of Perspex (G) which has its distal edge inclined at the same angle as the two oblique lines etched into the main board is positioned above the proximal end of the moving arm, but is detachable. Its sloping edge has initially to be adjusted accurately and should be able to be adjusted to a zero or other significant reading. Several guide lines, in arbitrary positions, but perpendicular to the length of the board when the arm is in position, are etched on the upper surface. Similarly orientated lines are etched distally on the under surface of the moving arm and are 4.55 mm apart. These form a Vernier scale with respect to the lines on the base.

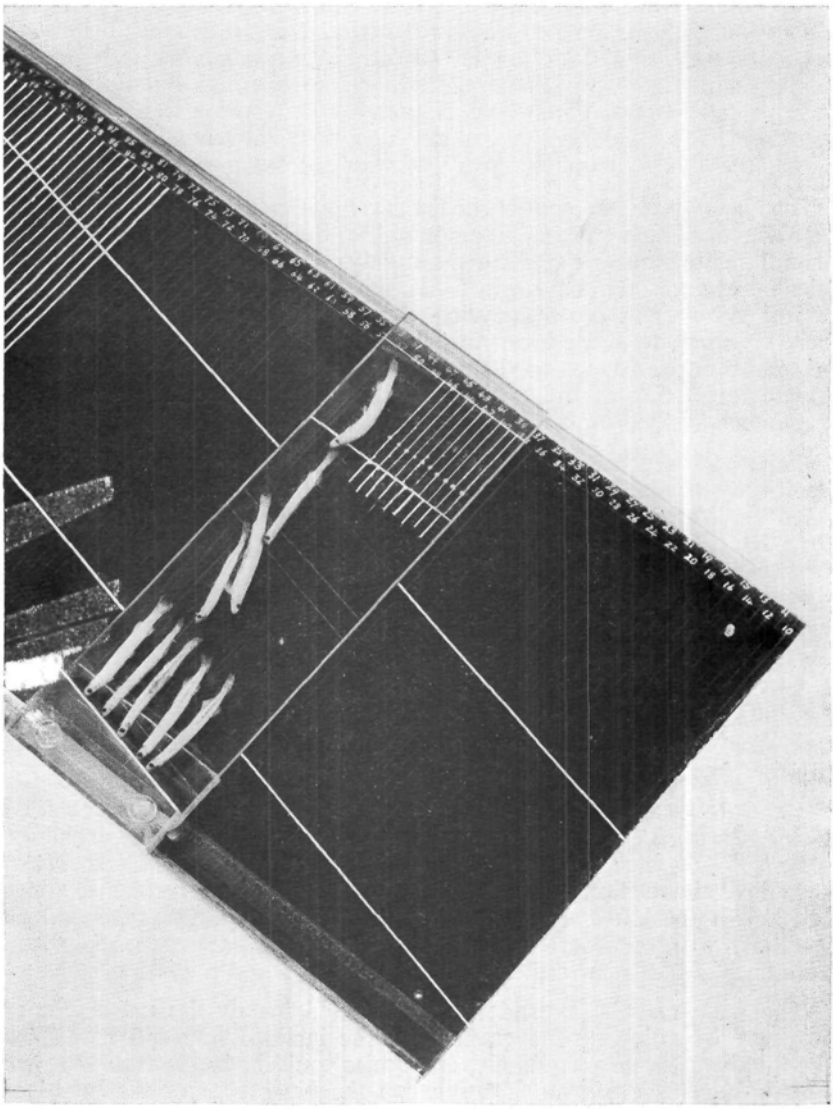

Photo: J. T. Darby

FIG. 2—Photograph of right portion of measuring board set at 37.9 (137.9) mm (not allowing for parallax on Vernier). Various lines are exaggerated artificially.

OPERATION

Specimens are placed on, and parallel to, the moving arm with their heads touching the inclined edge proximally. The arm is moved sideways until the fork of a fish's tail fin (if length to caudal fork is required) is perpendicularly above one of the oblique lines on the board. The precise positioning of the arm is possible by viewing one's reflection and the fish's tail and making any necessary movements of the arm along the rail to eliminate parallax with the main line.

The length measurement of the fish has now been determined, although no reference has been made to any number. The measurement is obtained in millimetre units by reading the number which refers to the perpendicular line on the base which lies immediately to the right of the right-hand margin of the moving arm. These numbers and the lines corresponding to them form an expanded scale with 1 mm increments of the object being measured spaced 5 mm apart. This spacing is related to the inclination of the two oblique lines which have, in this model, a gradient of one in five with respect to the runner.

Lengths, if required to tenths of a millimetre or decisions on millimetre values when readings are marginal (about 0.5 mm), are obtained by using the Vernier on the moving arm. The required reading is the digit, 0 to 10, on the line which is immediately above a parallel line on the base. Selection of the appropriate line on the Vernier can be made easily by viewing successive lines of the Vernier obliquely along their length and is aided by viewing multiple reflections of translucent marks etched along each line of the Vernier.

The piece of Perspex with the sloping edge on the moving arm can be removed and an engraved line marking this edge can be used as a base for recording measurements, such as head length, taken with dividers from the specimens.

Data are given in Table 1 (No. 5 and 6) for measurements recorded to the nearest 0.1 mm with proportional dividers and a simple expanded scale ($\times$ 2.5) in millimetre units, and with the dividers and the board described above. Some number bias is present in the former readings but not in the latter. From measurements of total length made on 50 small fish with this board, and repeated 2 weeks later, a mean individual difference of 0.21 mm resulted.

The scale may be expanded or contracted to any desired degree of accuracy by adjusting the gradient of the inclined line and modifying the numbered scale accordingly; two scales could be incorporated on one board. Various other modifications on the basic plan of the board as described above will suggest themselves for specialised requirements. Some advantages peculiar to the laboratory model are: (1) Only the little finger of each hand needs to be used to position the moving arm, and the remaining fingers are free to straighten contorted specimens. (2) Several specimens can be kept on the moving arm when it is in use. (3) Measurements can be read at any time between positioning the arm and repositioning it for the next measurement. (4) Measurements

can be made as quickly and conveniently as with a conventional measuring board.

The Zoology Department, University of Canterbury, is making other boards similar to that described.

ACKNOWLEDGMENTS

I wish to thank Professor G A. Knox for reading the manuscript, Messrs T. Jacobs and M. Cross for constructing the board shown in Figs 1 and 2, and colleagues who permitted me to quote their records.

REFERENCES

ALLEN, K. R. and CUNNINGHAM, B. T. 1957: New Zealand angling 1947–52. Results of the diary scheme. *Fish. Bull. N.Z. 12*. 153 pp.

WOODS, C. S. 1964: Fisheries aspects of the Tongariro power development project. *Fish. tech. Rep. N.Z. mar. Dep. 10*. 214 pp.