EDITORIAL

Editorial on writing equations and mathematical expressions: some basic principles

This Editorial provides some advice on writing equations and mathematical expressions for the *Journal of Fish Biology*.

1. Uppercase letters should be clearly distinguished from lowercase letters. A letter or symbol should represent only one entity and be used consistently throughout the paper. Each letter or symbol together with the unit in which it is measured, should be explained in the text at its first occurrence or, alternatively in case of extensive use of mathematical symbols, in a ‘Table of symbols’.

2. Vectors should be written in lower case bold font, e.g. \( \mathbf{a} \) and matrices in upper case bold, e.g. \( \mathbf{A} \). Other algebraic symbols (except Greek uppercase letters) including parameters and scalar variables should be written in italics. Operators such as \( \log \), \( e \), \( \cos \) and \( d \) should be written in regular (and not in italics unlike their associated variables \( x \) and \( y \): \( \log x \), \( e^x \), \( \cos x \), \( \frac{dy}{dx} \)). Note that \( e^x \) should normally be used unless the exponent is a complicated function when \( \exp(x) \) is acceptable.

3. Single letters (not abbreviations) should be used for algebraic symbols, qualifying them with subscripts (not italics) if required, e.g. the variables length \( L \), total length \( L_T \), index \( I \), gonado-somatic index \( I_G \), biomass \( B \), spawning stock biomass \( B_{SS} \). Subscripts should be written in italics in situations where they refer to a functional relationship, e.g. \( N_t = N_0e^{-\mu t} \), the equation describing the number of individuals \( N_t \) at time \( t \) given the instantaneous mortality rate \( \mu \) and the initial number \( N_0 \) at \( t = 0 \) [here, the notation \( N_t \) is equivalent to \( N(t) \)].

4. Mathematical symbols should not be placed at the beginning of a sentence, e.g. do not write ‘\( \alpha \) is the parameter describing . . . ’; it should be rephrased like for example ‘The parameter \( \alpha \) describes . . .’.

5. Superscripts (negative exponents) should be used instead of ‘/’ or ‘−’ for ratios, e.g. \( \left( -\frac{b \pm \sqrt{b^2 - 4ac}}{2a} \right)^{-1} \) for \( \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \). Exceptions are notations for derivatives that should be written with a horizontal line, e.g. \( \frac{dv}{dx} \) (Leibniz’s notation). Note that primed and dot notations will not be acceptable formats for indicating differentiation, i.e. \( y' \) or \( \dot{y} \) as \( \frac{dy}{dx} \) and \( y'' \) or \( \ddot{y} \) as \( \frac{d^2y}{dx^2} \).

6. The operators ‘*’ , ‘.’ or ‘\times’ should not be used for basic arithmetic multiplication (use nothing), and neither ‘**’ nor ‘\wedge’ in front of exponents (use superscripts). Note, however, that ‘\times’ is allowed in pure numbers and expressions like,
e.g. ‘the estimated value is $3.4 \times 10^{-3}$’ and ‘the fish were transferred to $1 \times 1$ m tanks’.

7. Hierarchical parentheses/brackets/braces, e.g. $\{(\ )\}$ (or parentheses differentiated by their size in cases where brackets and braces have a specific meaning) should be used to clarify the structure of a complex expression.

8. A space on either side of binary operator signs (e.g. $+$, $-$, $=$, $\Leftrightarrow$) should be included.

9. Numerals should always be written in regular. Distinguish between the lower case letter ‘l’ and the numeral ‘1’, and between the upper case ‘O’ and the numeral ‘0’. Exact values should not be presented by decimal numbers, e.g. $2^{-1}$ should not be written as $0.5$. Simple, exact fractions used as exponents in, for example, allometric relationships and available as single types on keyboards and expanded character sets, e.g. $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, are allowed. $\sqrt{M}$ or $\sqrt[3]{M}$ may be used instead of $M^{\frac{1}{2}}$ or $M^{\frac{1}{3}}$.

10. Short mathematical expressions and equations should be integrated into the normal text. All display equations (referred to explicitly in the text or expected to be referenced by other authors) should be centred in their separate lines and numbered consecutively. A display equation may be broken down if there is not enough space within one line. Then, each line should be aligned to either a symbol or a binary operator (e.g. $+$, $-$, $\Leftrightarrow$).

11. Arabic numbers identifying equations that are cited should be in parentheses and placed at the right-hand margin in the same line as the equation. Example:

$$L_t = L_\infty \left[1 - e^{-K(t-t_0)}\right],$$

(1)

where $L$ and $t$ are total length ($L_T$; mm) and age (years) of the fish respectively, $L_\infty$ is the asymptotic $L_T$, $K$ is the growth coefficient representing how fast $L_\infty$ is reached and $t_0$ is the theoretical age at which $L_T = 0$. The equations should be referenced within the text as ‘equation (1)’, ‘equations (1) and (2)’, ‘equations (1) – (3)’, ‘[equation (1)]’. If parts of the manuscript are highly mathematical in nature, it may be desirable to develop equations and formulae in appendices rather than in the main text.

12. Check that mathematical expressions and equations created in the native software are correctly displayed in the submission. It is recommended to use Equation Editor or LaTeX to create mathematical expressions and equations unless the manuscript contains only a minimum amount of mathematics.

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