

## 11. Symbols

This chapter explains the treatment of certain symbols and other technical designations, most of which pertain to chemistry, genetics, or fish ages and mortality, that are commonly used in fisheries science. Symbols pertaining to mathematics and statistics are covered in Chapter 4; see also the list of abbreviations and acronyms in Appendix B.

### Cell Cycle Phase

- 11.1** Cell cycle phases are indicated by capital letters in nonitalic type, i.e., G<sub>0</sub> (the quiescent phase after cell division), G<sub>1</sub> (the primary growth phase), S (the phase in which the genome is replicated), G<sub>2</sub> (the growth phase in which the cell prepares for genomic separation), M (mitosis [genomic separation]), and C (cytokinesis [cell division]).

### Cell Lines and Bacterial Strains

- 11.2** Cell lines are usually indicated by their acronyms, but the type must be spelled out at first mention:

Chinook salmon embryo (CHSE-214) cells

- 11.3** For bacterial strains that are maintained by standard type culture collections, the complete name of the collection should be given at first mention:

*Flavobacterium psychrophilum* ATCC (American Type Culture Collection) 49418

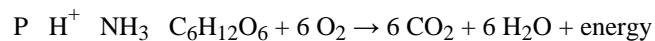
Acronyms such as ATCC may then be used for subsequent references to that collection.

For strains that are maintained by individual laboratories, the laboratories' identifying codes should be given:

*Aeromonas* 1-75

### Chemical Terms

- 11.4** Standard chemical symbols may be used for elements, compounds, and equations without further explanation:



If a sentence begins with the name of an element or compound, however, that name must be spelled out along with any others that occur in the sentence:

Phosphorus and nitrogen. . . . *not* Phosphorus and N. . . . *or* P and N. . . .

**11.5** Compounds may also be indicated by their generic and “chemical” names:

formalin rotenone [generic]  
17 $\beta$ -hydroxyandrost-4-en-3-one [chemical]

Letters indicating the dextro and levo configurations (D- and L-, respectively, should be small capitals.

The following prefixes should be italicized:

<i>cis-</i>	priority groups are on the same side of the reference plane
<i>m-</i>	meta
<i>N-</i>	attached to a nitrogen atom (e.g., <i>N</i> -methylpyridine)
<i>o-</i>	ortho
<i>O-</i>	attached to an oxygen atom (e.g., <i>O</i> -acetylhydroxylamine)
<i>p-</i>	para
<i>S-</i>	attached to a sulfur atom (e.g., <i>S</i> -methylcysteine)
<i>tert-</i>	tertiary
<i>trans-</i>	priority groups are on opposite sides of the reference plane

Generic names that appear in *Webster’s Third New International Dictionary* (or the current edition of *Merriam-Webster’s Collegiate Dictionary*) or as main entries in the *Merck Index* (Merck & Co., Rahway, New Jersey) or *Dorland’s Illustrated Medical Dictionary* (W. B. Saunders Company, Philadelphia) may be used without a chemical name. Other generic names must be accompanied by a chemical name at first mention.

**11.6** Acronyms that appear in *Webster’s Third New International Dictionary* or the current edition of *Merriam-Webster’s Collegiate Dictionary* do not need to be spelled out:

DDT EDTA

TRADE NAMES

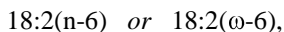
**11.7** Compounds may be referred to by trade name, but the generic name or a general description must be given at first mention:

MS-222 (tricaine methanesulfonate)  
the vaccine Furogen 2

Trade names are often capitalized (see section 2.5).

#### FATTY ACIDS

**11.8** Fatty acids may be indicated by name (e.g., linolenic acid) or by notation of the sort

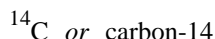


where the number to the left of the colon is the number of carbon atoms in the compound, the number immediately to the right of the colon is the number of double bonds, and the number after the hyphen indicates the position of the first double bond from the methyl end.

The numerical notation must be accompanied by an explanation like that above.

#### RADIOACTIVE ELEMENTS

**11.9** Radioactive elements may be indicated in either of the following two ways:



The usage must be consistent within the paper, however.

#### Enzymes

**11.10** At first mention, standard enzymes (those with names ending in “-ase”) are referred to both by name and by the numbers assigned to them by the Nomenclature Committee of the International Union of Biochemistry and Molecular Biology:

creatine kinase (enzyme number 2.7.3.2; IUBMB 1992)  
 $\text{Na}^+, \text{K}^+$ -ATPase (3.6.1.36)

The following citation should appear in the list of references:

IUBMB (International Union of Biochemistry and Molecular Biology). 1992. Enzyme nomenclature 1992. Academic Press, San Diego, California.

As the above examples suggest, the IUBMB citation and the words “enzyme number” need only appear in the text the first time an enzyme number is given.

**11.11** After full identification, enzymes may be abbreviated according to the conventions adopted by the Fish Genetics Nomenclature Committee of AFS’s Fish Genetics Section (see J. B. Shaklee et al. 1990. Gene nomenclature for

protein-coding loci in fish. Transactions of the American Fisheries Society 119:2–15, especially Tables 1 and 2):

CK [creatine kinase]

bGAL *or* βGAL [beta-galactosidase]

sAAT, mAAT [cytosolic and mitochondrial aspartate aminotransferase]

IDHP-1, IDHP-2 [isozymes of isocitrate dehydrogenase]

#### RESTRICTION ENZYMES

**11.12** Restriction enzymes (also known as endonucleases) are derived from bacteria and have a different nomenclature that reflects their origin:

*Taq* *Acc* I *Hinc* II

Thus, *Taq* is derived from the bacterium *Thermus aquaticus*, *Acc* I is the first enzyme derived from *Acinetobacter calcoaceticus*, and *Hinc* II is the second enzyme derived from the Rc strain of *Haemophilus influenzae*.

Note that when the name has more than three letters only the first three are italicized.

#### Gas Pressure

**11.13** The partial pressure of a gas is indicated as follows:

$P_{O_2}$  *or*  $p_{O_2}$

Note that letters such as O (for oxygen) are in small capitals.

#### Genetics

**11.14** Genes (also known as loci) are designated by the abbreviations of the enzymes they encode, with two typographic differences: (1) an asterisk follows the enzyme abbreviation and (2) the entire expression (including the asterisk) is italicized:

*CK\** *bGAL\** *sAAT\** *IDHP-1\**

The enzymes themselves should be named in full (see section 11.10) when such abbreviations are used.

Designations for genes that encode subunits of enzymes are italicized but not followed by an asterisk:

*ND-4* *ND-6* [subunits of NADH (the reduced form of nicotinamide adenine dinucleotide) dehydrogenase]

## ALLELES

**11.15** Alleles may be indicated by appending Arabic numbers, lowercase letters, or relative electrophoretic mobilities to the gene abbreviations:

*EST-2\*1, EST-2\*2 . . . or EST-2\*a, EST-2\*b . . . or EST-2\*100, EST-2\*75 . . .*

The Fish Genetics Nomenclature Committee recommends using Arabic numbers but providing the corresponding electrophoretic mobilities. However alleles are designated, a full description of the conditions under which the electrophoretic differences were determined should be given.

Alleles may be indicated without the gene abbreviations as long as it is clear to which genes they belong:

Four alleles of *EST-2\** were observed: \*1, \*2, \*3, and \*4 [or \*100, \*75, \*150, and \*43].

Multiple alleles in a genotype should be separated by forward slashes:

*EST-1\*100/55 sAAT-1,2\*130/100/100/80*

Haplotypes, which are groups of alleles that are inherited together, are printed in nonitalic type:

MYS21

## MICROSATELLITES

**11.16** Microsatellites are a class of nuclear DNA markers consisting of small (1–5-base-pair) repeating sequences that are often studied in lieu of genes per se. They are designated solely by their abbreviations, which are italicized except for any Greek letters they contain:

*Ots1 Ssa85 Oneμ3*

## PLOIDY

**11.17** Ploidy, the degree of repetition in the basic number of chromosomes that an organism possesses, is indicated by a number and a lowercase “n” in nonitalic type:

2n [diploidy] 4n [tetraploidy]

## FILIAL GENERATION

**11.18** Filial generation is indicated by a capital “F” in nonitalic type and a numerical subscript:

$$F_1$$

## FIXATION INDEXES

**11.19** Fixation indexes are statistics of the form

$$F = (H_e - H_o)/H_e$$

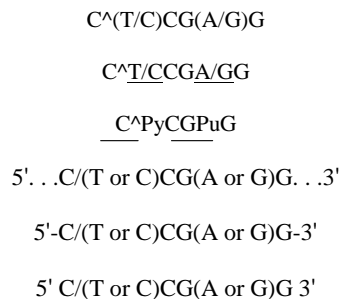
that measure the degree of difference between expected heterozygosity ( $H_e$ ) and observed heterozygosity ( $H_o$ ). The most commonly used index, which compares the genetic composition of discrete populations within a larger metapopulation, is denoted  $F_{ST}$ . It is not necessary to provide a detailed explanation of such an index, but a general explanation should be given at first mention:

the genetic differentiation index  $F_{ST}$

Note that the subscript is in capital letters.

## DNA BASE CUTTING

**11.20** The sites at which restriction enzymes cleave DNA may be indicated in a number of ways, including the following:



In these expressions, the letters C, T, G, and A represent the four bases found in DNA, namely, cytosine, thymine, guanine, and adenine (uracil [U] replaces thymine in RNA). The numbers 5' and 3' refer the carbon atoms at the two ends of the nucleotide chain.

The fact that one of two alternative bases may be present at a particular site can be indicated in four ways: (1) (T/C), (A/G); (2) T/C, A/G; (3) Py, Pu, which stand for the pyrimidine (T, C) and purine (A, G) bases, respectively; and (4) (T or C), (A or G).

In the first three examples, a caret (^) denotes the cutting site; in the last three examples, a forward slash does.

## Hormones and Antibodies

**11.21** Hormones and antibodies may be denoted by their standard abbreviations or acronyms but must be spelled out at first mention:

luteinizing hormone releasing hormone (LHRH)  
immunoglobulin A (IgA)

## Lethal Concentrations and Doses

**11.22** Terms indicating lethal concentrations and doses may be abbreviated but must be explained in full at first use:

the concentration [dose] that was lethal to 50% of the test organisms over the first 96 h (LC50 [LD50])

the dose that produced a cytopathic effect in 50% of the inoculated cultures (TCID50)

Note that the percentage of organisms affected and the time of exposure may vary and that numbers such as 50 are not treated as subscripts in AFS publications.

## Fish Mortality

**11.23** Symbols denoting fish mortality rates should be defined at first use:

instantaneous fishing mortality ( $F$ )

instantaneous natural mortality ( $M$ )

Subscripts are sometimes used to denote more specific mortality rates:

the fishing mortality at which yield per recruit is at a maximum ( $F_{\max}$ )

## Fish Ages

**11.24** References to fish by age-class may be made as follows:

age-0 bluegills   age-2 fish

The term “young-of-the-year” may be used in lieu of “age-0,” but it may not be abbreviated to “YOY”:

young-of-the-year bluegills   *not*   YOY bluegills

A term such as “age-1+” may be used to refer to fish of age 1 and older as long as an explanation is given. However, such a term may not be used to indicate growth beyond the first annulus.

ANADROMOUS SALMONIDS

**11.25** The preferred way to refer to the age of an anadromous salmonid is as follows:

age 2.2 age 0.3

In this system, the first digit is the number of winters spent in freshwater and the second digit is the number of winters spent in the ocean.

References to only the freshwater or ocean portions of a fish's life may be made as follows:

age 2. age .2