A Guide to AFS Publications Style

Preface

The term "style" refers to the various editorial conventions adopted by a publisher. Many of these—notably the ones pertaining to grammar, spelling, punctuation, and so forth—are common throughout the publishing world. Others—notably those pertaining to reference formats and the treatment of technical terms—vary from publisher to publisher. As a scientific publisher, the American Fisheries Society (AFS) uses a highly precise style that is intended both to facilitate communication within the fisheries profession and to ensure the integrity of its publications.

The first comprehensive guide to AFS style appeared in 2004. The present guide differs from the first one in two respects: it reflects the changes in AFS style that have occurred over the last six years, and it offers more detailed coverage of difficult points.

The guide is intended to serve two different groups of users, namely, authors and the copy editors and others responsible for putting manuscripts into final form. As a result, not all of the information in the guide will be of interest to all users. For instance, it includes sections on grammar and so forth that will be "old hat" to copy editors but that may be useful to authors; in the same vein, it provides explanations of several scientific concepts with which copy editors will probably be unfamiliar.

Every effort has been made to enable users to obtain the information they want with a minimum of time and effort. The sections have been kept short, with numerous headings; style points are presented in terms of simple rules; and the examples that are given deal with situations that are encountered frequently. In many cases it may be possible to resolve a style question simply by looking at the examples.

To facilitate locating all of the information on a particular topic, a number of cross-references are provided. There is also some intentional redundancy in the presentation. For instance, the fact that gene names are italicized is noted both in the chapter on symbols and in the chapter on the use of italics.

Although most of the guide is devoted to specific style points, the introduction offers some general pointers on scientific writing that should be of value to both authors and copy editors.

Given the vast number of style questions that can arise, no guide can really be complete. For points that aren't covered, users should contact the Journals Department at 301-897-8616 or journals@fisheries.org.

Finally, in the interest of making this guide as useful as possible and keeping it up-to-date, users are encouraged to offer suggestions for future editions.

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Introduction

Published articles are the permanent records of research efforts. They may be read well beyond the author's professional circle and even beyond his or her lifetime. For this reason, among others, they must meet strict standards for both content and presentation.

The peer review process is designed to ensure that the papers published by the American Fisheries Society (AFS) are relevant and scientifically sound, that is, that the approach is acceptable, the evidence presented is adequate, and the conclusions are reasonable in light of the evidence.

The editing process focuses primarily on presentation. Authors sometimes wonder why editors are so strict, given that violations of the rules of composition seldom interfere with the communication of ideas. There are two reasons. First, poor writing places an additional burden on readers—it forces them to work out what the author means rather than grasping it directly. To take a simple example, suppose that an author uses different terms for the same concept, say, "sampling sites" in some places and "locations" in others. Readers have to make the connection between the two terms on their own, expending effort that would be better devoted to understanding the substance of the paper. The second reason is that poor writing lowers the author's credibility. However subtly, errors such as faulty grammar cast doubt on the quality of the underlying research; readers instinctively begin to wonder whether they can trust the author on more substantive points.

This guide contains a wealth of information on the fundamental elements of composition—grammar, spelling, punctuation, and so forth—as well as the ways in which AFS publications treat technical terms and symbols. The first step in writing a good paper is thus to become thoroughly familiar with the material in this guide and to consult it as needed during the writing process.

Over the years, the editorial staff have noticed that certain problems occur over and over in papers submitted for publication, so it will be useful to highlight them here.
One overarching problem is a lack of formality—the use of slang, undefined acronyms, abbreviated forms of expression, and so forth. Many authors, for instance, violate the general rule on using the full common names for fish species at each mention, using, say, "Chinook" for "Chinook salmon." (While AFS style permits the use of "salmon" or even "fish" when the species is mentioned frequently [see section 9.4], it does not permit the use of "Chinook" alone.) In the same vein, authors frequently use acronyms such as dNTP (deoxynucleotide triphosphate) without explanation. If such a term is used only once or twice, it must be spelled out; if it is used more often, it must be spelled out the first time but may then be abbreviated as long as the abbreviation is given the first time (see section 1.2).

Another overarching problem is the use of language that is not natural. Although the use of technical terms is certainly acceptable, in other respects papers must be written in ordinary English and not read like transcriptions of lab notes or seminar presentations. One particularly egregious example is the omission of the words "the" and "that" when the rules of grammar clearly require them. Consider the sentence

Fish we studied were age-0 hybrids.

In general, this sentence should be written

The fish *that* we studied were age-0 hybrids.

(see chapter 14 for the exceptions to this rule). Additional examples of unnatural language are given in the sections that follow.

So far, then, we have the general rule: *write naturally but with the formality required of a scientific paper*. We can flesh this rule out by noting that good writing must fulfill three conditions: it must be correct, it must be clear, and it must be reasonably smooth. Let us look at the three conditions in turn.

Correctness

From the standpoint of presentation, correctness means (1) adhering to the accepted rules of composition and the particular elements of AFS style and (2) expressing ideas accurately.

As noted above, much of this guide is devoted to helping you meet the first objective. Let's say that you are uncertain whether to write "main stem reaches" or "main-stem reaches"; section 10.12 will show you that "main-stem" is the correct form when the term is used as an adjective, as it is in this case. Similarly, section 2.9 will show you that the first word in the term "upper Mississippi River" is not capitalized because it is not part of a formal name.

One area in which authors frequently make errors is word choice. Take the classic example, "that" versus "which." Although the two terms can sometimes be used interchangeably, at other times the distinction is crucial. For instance, the expression "The fish that were moribund" implies that only some of the fish were moribund, whereas the expression "The fish, which were moribund" implies that all of them were. Other examples are given in Chapter 14 of this guide.

Authors are also frequently in doubt as to the correct treatment of technical terms and symbols. For instance, should family names such as Ictaluridae be italicized? The answer is no (see section 9.3). What is the accepted abbreviation for the dosage that is lethal to 50% of the test animals? Appendix B shows that it is LD50 rather than LD_{50}.

With respect to the second element of correctness, expressing ideas accurately, consider the following example showing both the original and edited versions:

> The variable~~concerns about~~ pH is primarily of concern because of~~center on~~ its effects on ~~the toxicity of~~ other variables~~,~~ such as the toxicity of ammonia~~ toxicity~~ and heavy metals~~ toxicity~~.

There are two problems with the original version. First, variables per se cannot be toxic; second, it refers to the toxicity of (ammonia and heavy metal) *toxicity*, which is tautological.

Here is another example of inaccurate expression:

> As lampreys lose body mass, the branchial basket appears to remain constant in size ~~compared with other body parts~~.

The original version is logically flawed because the size of the branchial basket remains constant regardless of what happens to the other body parts.

A classic (and often comic) case of inaccurate expression is the dangling participle. Here's an example:

> By hatching prematurely, the diffusion barrier created by the chorion and the water in the perivitelline space disappears.

What the author meant was

> When fish hatch prematurely, the diffusion barrier created by the chorion and the water in the perivitelline space disappears.

The original literally states that the diffusion barrier hatches, which is not the case.

Clarity

A statement may lack clarity because its meaning is simply unclear or because it is ambiguous (i.e., more than one interpretation is possible). Here is an example of simple lack of clarity:

> Each fish received an intraperitoneal injection with 0.1 mL ~~of one of the two vaccines~~ of the vaccine Furogen 2 or 0.1 mL of sterile 0.9% NaCl (control). ~~Control fish were vaccinated with an injection of 0.1 mL of sterile 0.9% NaCl~~.

The original version fails to make clear that only one vaccine (Furogen 2) was compared with NaCl (the control) and errs in calling the latter a vaccine.

Here is an example of ambiguity:

> Blood was taken ~~while fish were anesthetized~~ by inserting heparinized needles into the caudal vasculature while fish were anesthetized.

The original version is ambiguous because it is not clear whether the insertion of heparinized needles into the caudal vasculature was for the purpose of anesthetizing the fish or drawing blood from them.

Smoothness

There are several issues to consider in constructing smooth statements.

Awkwardness.—Awkward sentence structure crops up in virtually all types of writing. Perhaps the best advice for avoiding it is to state your ideas as simply as possible. Consider the following two examples:

> Counts became lower as sampling moved to deeper water because~~due to~~ the latter quadrants were~~being~~ less likely to have favorable substrate and therefore fewer red sea urchins.

> There were only four instances in which ~~Issues regarding~~ transceivers detected~~ing,~~ a transponder's code but displayed it incorrectly. ~~displaying a transponder's code were rare in this study. In fact, the only instances in which tag codes were encountered (N = 4)~~All of these involved AVID-encrypted transponders.

In the first example, only two simple changes are needed to eliminate the awkwardness. In the second example, more extensive streamlining is required, including the transfer of some information from the second sentence (in the original) to the first.

Verbosity.—Using more words than necessary to convey the idea is a common problem in scientific writing. Consider a particularly bad example:

> Fish that were vigorously chased showed significantly higher plasma cortisol levels than control fish. Although the plasma cortisol levels of these alewives were significantly higher than the levels of fish that did not experience vigorous chasing, the plasma glucose levels in these alewives were not affected.

This can be streamlined to

> Although the alewives that were vigorously chased had significantly higher plasma cortisol levels than those that were not, they experienced no change in their plasma glucose levels.

Here's a less egregious example:

> Although our reasoning ~~for drawing this conclusion~~does not completely match that of~~the reasoning used by~~ Smith (1970), we agree ~~with Smith (1970)~~that the restoration of Great Lakes fish communities will require further reductions in the number of alewives.

In this example, the phrases "for drawing this conclusion" and "with Smith (1970)" have been deleted because they contribute nothing to the meaning of the sentence and the phrase "the reasoning used by" has been changed to "that of" to avoid unnecessary repetition.

As the last example suggests, one way to reduce verbosity is to use pronouns ("that") in place of nouns ("the reasoning") whenever the meaning is clear. Despite the widespread belief to the contrary, pronouns are perfectly acceptable in formal writing and do much to improve it.

Another way to avoid verbosity is to use shortened forms of expression for concepts that have already been stated in full:

> The fish in zone 1 were the heaviest (130 ± 17 g [mean ± SD]), followed by those in zone 2 (125 ± 12 g~~[mean ± SD]~~) and then those in zone 3 (122 ± 13 g~~[mean ± SD]~~).

Since it is clear from the first mention that all of the values given are means ± SDs, repetition of that information is not necessary.

Noun "*sandwiches*."—Closely related to verbosity is the practice of piling up nouns one after the other. Here's a relatively inoffensive example:

> This development would lessen the responses of the~~Norris Lake~~ largemouth bass populations ~~responses~~ in Norris Lake to the imposition of length limits.

In addition to being inelegant, noun sandwiches can obscure the key relationships involved.

Lack of parallelism.—Parallelism means presenting similar information in a similar fashion. Here's an example:

> ~~Winter m~~Mortality due to harvesting and other causes was lower in winter than in summer.

Apart from being awkward, the original leads readers to believe that the subject is winter mortality rather than mortality per se, a misconception that is only corrected when they have read the entire sentence.

Here's another example:

> We recorded the reactions of the rainbow trout but not those of the brown trout.

The addition of the words "those of" makes it clear that it is the *reactions* of the two species that are the object of the sentence.

Unidiomatic expression.—Every language has its own particular conventions known as "idioms." For instance, in English one would say "English is the principal language of the United States." In French, however, one would say the equivalent of "The English is the language principal of the United States." Unidiomatic expression is surprisingly common in scientific writing. Here's a simple example:

> We designed the experiment to ~~answer~~address this issue.

Alternatively, the sentence could have been rewritten as

> We designed the experiment to answer this question.,

but the phrase "to answer this issue" may not be used because it is not idiomatic.

Here's a more complicated example of unidiomatic expression that is also somewhat awkward:

> This stems from the direct role that ~~causal relationship~~the growth factor plays in ~~directly~~ regulating cellular proliferation.

The original is incorrect because growth factors do not "play" causal relationships.

1. *Abbreviations and Acronyms*

This chapter presents the general principles governing the use of abbreviations and acronyms. In addition, see sections 5.18–20 and 5.24 on units of measure and Chapter 11 on symbols.

1.1 An abbreviation is a shortened form of a word or phrase:

Inc. g e.g.

An acronym is a word formed from the first letters of the words in a compound term. Although acronyms often consist of all capital letters, they may consist of all lowercase letters or a combination:

AFS ppm mRNA

A list of abbreviations and acronyms that are used frequently in fisheries writing appears in Appendix B.

SPELLING OUT

1.2 As a rule, do not introduce an abbreviation or acronym unless it is used at least three times, and spell it out at first use:

Polymerase chain reaction (PCR) was used to. . . .

Exceptions are abbreviations and acronyms that

- are listed as standard abbreviations and acronyms in an AFS journal or book[1]
- have entries in *Merriam-Webster's Collegiate Dictionary* (e.g., DNA)
- have entries in the *Merck Index* (Merck & Co., Rahway, New Jersey)
- are noted in sections 1.4–1.7

1.3 Once an abbreviation or acronym has been introduced, it should be used in lieu of the full term except when the term occurs at the beginning of a sentence:

Food and Drug Administration regulations require that. . . .

not FDA regulations require that. . . .

[1] Each journal has its own list of standard abbreviations and acronyms located in the back of every issue. The lists for books are usually located in the front. For *Fisheries*, use the list given in *Transactions of the American Fisheries Society*.

If necessary, rewrite the sentence to avoid beginning it with an acronym:

Analysis of the specimens' DNA showed that. . . .

not DNA analysis showed that. . . .

1.4 Certain stylistic abbreviations may be used:

e.g. i.e. etc. et al.

Note that the first three of these abbreviations may only be used in parenthetical expressions and that commas must follow the first two.

The following abbreviations are also permissible:

Co. Corp. Inc. Ltd.

1.5 An author may be referred to by his or her initials in the acknowledgments, footnotes, or text:

a grant to J.P.D. (J.T.S., unpublished data)

Place Names and Addresses

1.6 The following abbreviations may be used in place names and addresses:

St. [Saint] Ste. [Sainte] Mt. [Mount]

D.C. U.S. [as adjective] USA [as noun] UK [as noun or adjective]

1.7 The abbreviations NE, NW, SE, and SW (indicating sections of cities) and those denoting ordinal numerals ("-st," "-nd," "-rd," and "-th") may be used in addresses:

1234 Massachusetts Avenue NW
Washington, D.C. 20007

719 East 42nd Street New York,
New York 10123

Note that "East," "West," "North," and "South" must be spelled out.

1.8 Other elements of addresses must be spelled out:

Post Office Box 95
Silver Spring, Maryland 20901

Note that except in authors' addresses it is not necessary to include the country name after U.S. and Mexican states and Canadian provinces.

USE WITH ARTICLES

1.9 When an acronym is read as a word, it is generally used without an article ("the," "a," or "an"):

In this regard, ANOVA revealed that. . . .

When it is read as a series of letters, however, it is generally used with an article:

by means of a DBA [dot blot analysis] the CTM [critical thermal maximum]

PLURALS

1.10 Abbreviations and acronyms should be considered singular and add an *s* to form the plural unless they are units of measure or inherently plural:

environmental impact statements (EISs) means and SDs

but National Institutes of Health (NIH) geographical information systems (GIS)

2. *Capitalization*

PROPER NOUNS AND ADJECTIVES

2.1 Capitalize the names of organizations:

U.S. Fish and Wildlife Service

U.S. Government *but* Canadian government federal government

2.2 Capitalize personal titles when they are used with the person's name but not when they are used alone:

Secretary of the Interior Smith

the secretary of the interior

2.3 Capitalize the formal names of programs:

the Chesapeake Bay Program *but* a habitat restoration program

2.4 Do not capitalize terms relating to general concepts, even when they include a person's name:

index of biotic integrity Spearman's rank correlation coefficient

2.5 Capitalize certain trade names:

Plexiglas Styrofoam *but*
formalin petri dish

To determine which trade names to capitalize, consult *Webster's Third New International Dictionary* or the current edition of *Merriam-Webster's Collegiate Dictionary*.

Also capitalize the formal titles of software programs:

Restriction Enzyme Analysis Package

2.6 Capitalize the names of ships and aircraft:

RV *Seth Gorden*

Note that only the name per se is italicized.

Geographic and Geological Terms

Sections 2.7–2.14 present the general principles governing the capitalization of these terms; a more detailed list is given in Appendix D. For geographic terms that are not on that list, consult *Webster's New Geographical Dictionary*.[1]

POLITICAL DIVISIONS

2.7 Capitalize all words that are parts of formal names:

Washington State *but* state of Washington

Province of Ontario *but* Canadian provinces

TOPOGRAPHICAL AND PLACE NAMES

2.8 Capitalize all words that are parts of formal names:

Catskill Mountains Colorado River Midwest North Atlantic Pacific Northwest

2.9 Do not capitalize words that are purely descriptive:

Hudson River valley

Gulf coast of Texas *but* Gulf Coast [as region]

upper Mississippi River *but* Upper Peninsula [Michigan]

2.10 Capitalize popular names:

Deep South

Eastern Shore [Maryland] *but* the eastern shore of Hudson Bay

West Coast [U.S.] *but* the western coast of Florida

2.11 Certain structures and defined areas should be capitalized:

Grand Coulee Dam

Lock 19 Pool 12 [Mississippi River]

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[1] For several reasons, geographic terms sometimes have variant spellings. As far as possible, use the variants that are appropriate to American English, e.g., "Mexico" rather than the Spanish "México" (although the latter should be used in addresses and names of organizations).

2.12 Do not capitalize generic terms used in the plural when they follow specific terms:

Rappahannock and Rapidan rivers *but* Lakes Erie and Ontario

Note that generic terms that are not used in the plural are capitalized even when they are part of compound expressions:

Rappahannock and Rapidan River floods

2.13 Do not capitalize shortened names:

the bay [referring to the previously named Chesapeake Bay]

GEOLOGICAL TERMS

2.14 With the exception noted in section 2.9, capitalize all parts of such terms:

Wisconsin Glaciation Burgess Shale

Appalachian Highlands Piedmont Province Tennessee Section

Upper Pennsylvanian Late Oligocene

Taxonomic Names

2.15 Capitalize the names of genera, families, orders, classes, phyla, and kingdoms and the first component of species names:

Oncorhynchus

Salmonidae *but* salmonids
Salmoniformes

Ictalurus punctatus

Proper Adjectives

2.16 Capitalize adjectives derived from proper nouns:

Mendelian North American

OTHER USES

2.17 Capitalize terms such as “table,” “figure,” and “chapter” when they refer to specific items. Also capitalize terms such as “methods” and “results” when they refer to sections of a paper:

Table 1 Figure 2 Chapters 5-7 For additional details, see Methods. As noted in Results, . . .

Do not capitalize other identifying labels:

experiment 2 tank 3

2.18 Capitalize compass directions:

N ENE 10°6'N, 8°37'W

Note that latitude and longitude coordinates are separated by a comma and a space but that there are no spaces within the coordinates themselves.

3. *Italics*

3.1 Genus and species names should be italicized:

Acipenser spp. *Esox lucius*

3.2 Single-letter mathematical and statistical terms should be italicized unless they are Greek letters:

L_t L_1 r^2 *F*-value $P = 0.05$
but ß Δ

3.3 All elements of gene and allele designations (but not those for the enzymes for which they code) should be italicized:

*mAAT** *EST-1** **150* *GPI-A*1/2*

Note that the asterisks in these terms are italicized as well.

All elements of microsatellite designations except Greek letters should be italicized:

Ssa85 *One*μ*3*

3.4 Certain other technical terms and abbreviations should be italicized:

Taq [a restriction enzyme] chlorophyll *a* *g* [gravity] *F* [fishing mortality]

See Chapter 11 and Appendix B for other such terms and abbreviations.

3.5 The names of ships and aircraft should be italicized (but not type designators such as "USS" and "RV"):

RV *Seth Gorden*

3.6 Foreign words should be italicized:

In French, the brook trout is known as the *omble de fontaine*.

However, words of foreign origin that have been incorporated into English should not be italicized:

barranca thalweg in vitro

All of the words in the main section of *Merriam-Webster's Collegiate Dictionary* should be treated as English words; those in the section called "Foreign Words & Phrases" should be treated as foreign words.

3.7 Italics may be used for emphasis provided that the use is sparing:

> However, we observed this in *small* streams too. [i.e., where it was not expected]

3.8 Words used as words should be put in quotation marks rather than italics:

> In this context, the term "recruitment" means. . . .

However, letters used as letters are generally italicized:

> The letter *X* marks the location of the study site.
>
> *but* U-shaped valley

4. *Mathematics and Statistics*

SYMBOLS

4.1 All mathematical symbols consisting of single letters from the Latin alphabet should be italicized; the same is true for the vast majority of statistical symbols. All other symbols, including single Greek letters, should be in ordinary type:

$$z \quad s^2 \quad W_r \quad y = f(x) \quad t\text{-test}$$

$$\beta \quad \text{TL} \quad \text{CPUE}_t \quad L_{\text{init}}$$

Note that subscripts and superscripts are treated as separate symbols for this purpose; that is, a subscript or superscript consisting of a single letter should be italicized even if the main symbol is not, and conversely.

See Appendix A for the treatment of specific mathematical and statistical terms.

4.2 If punctuation follows a superscripted term, it should come after the superscript:

$$\ldots \text{ a higher value of } R^2, \text{ which implies } \ldots$$

LOGARITHMS

4.3 Logarithms are denoted by the abbreviation "log" with a subscript indicating the base (usually *e* or 10):

$$\log_e \text{ (}\textit{not}\text{ ln)} \quad \log_{10}$$

Note that *e* is italicized.

4.4 As a rule, there should be no space between the terms "$\log_e$" and "$\log_{10}$" and the variables and coefficients with which they appear:

$$1.23\log_e x$$

However, if the resulting expression is awkward, spaces, center dots, and parentheses may be used for clarity:

$$7.81\ \log_e x \quad 7.81 \cdot \log_e x \quad 1.23\log_e(\text{TL})$$

4.5 When the term "log" is used as a prefix, it is usually followed by a hyphen:

log-likelihood function log-linear model log-transformed data

but lognormal(ity) The data were log transformed.

However, nouns and adjectives involving "$\log_e$" and "$\log_{10}$" are not hyphenated:

$\log_{10}$ transformation $\log_e$ transformed data

VECTORS AND MATRICES

4.6 Vectors and matrices should be in bold type:

$\mathbf{x}$ $\mathbf{U}$

The operators in cross products (which are indicated by times signs and result in vectors) and dot products (which are indicated by center dots and result in single numbers [scalars]) should also be in bold type:

$\mathbf{w} \times \mathbf{y}$ $\mathbf{z}\,\mathbf{x}$

EQUATIONS

Formatting

4.7 Authors usually employ specialized software to insert equations into their manuscripts. Although copy editors can format simple equations as part of the normal copyediting process, more complex equations and those involving special symbols (such as integral and summation signs) will need to be marked for typesetting. In either case, the goal is to present equations in a readily understandable format.

Two guidelines that are useful in this regard are (1) to break lines before an operator, preferably a plus or minus sign, and (2) to use spacing, parentheses and their equivalents, and (in the case of multiplicative terms) center dots or times signs to group terms logically:

$$\log_e(N_t+1) = \log_e(\alpha) + \log_e(N_t) - \log_e[1 + (N_t/\gamma)]^{\beta}$$

4.8 Variable definitions may either be run into the text or presented in a list. There are two formatting options when they are run into the text:

$$dN/dt = rN\cdot[(K - N)/K],$$

where N is the population at any given time, r is the rate of population increase, and K is the carrying capacity of the environment.

or

where N = the population at any given time, r = the rate of population increase, and K = the carrying capacity of the environment.

A list is preferable when there are numerous terms or they appear in more than one equation:

$$C = (M_r + M_a + \text{SDA}) + (F + U) + (G_s + G_r);$$

C = the rate of energy consumption;
M_r = the standard metabolic rate;
M_a = the increase in metabolic rate due to activity;
. . . .

Note that in the list (1) variable definitions should begin one em dash from the margin, (2) the equals signs should be aligned, and (3) any overflow should be hang-indented to the right of the equals sign.

4.9 In mathematical expressions, the sequence { [( )] } should be used for grouping terms:

$$t = [(x_1 - x_2) - D_0]/\{s[(1/n_1) + (1/n_2)]^{1/2}\}$$

(The reverse sequence is used in ordinary text.)

Text References

4.10 Numbered equations should be referred to in the text as follows:

equation (1) equations (2) and (3) equations (2)–(5)

When the reference itself appears within parentheses, the parentheses around the equation number should be omitted:

The most reliable estimates (from equation 7) . . .

STATISTICS

4.11 Simple summary statistics (means, ranges, and standard deviations [SDs] or errors [SEs]) may be reported in any of several ways:

(mean, 45.2 mm) (mean = 45.2 mm) *not* (mean 3.2)

(mean, 45.2 mm; SD, 3.84) *or* (mean = 45.2 mm; SD = 3.84)
or 45.2 ± 3.84 (mean ± SD)

Whichever form is used must be used consistently, however. Avoid using expressions such as

The mean total length was 45.2 ± 3.84 mm.

because they are inaccurate (the mean was 45.2 mm, not 45.2 ± 3.84 mm).

Note that the term "coefficient of variation" must be defined as the percentage ratio of the standard deviation (or error) to the mean:

The coefficient of variation (100·SD/mean) was. . . .

4.12 The results of statistical tests should be reported by giving the test statistic (and, if it is not obvious, the type of test), the degrees of freedom, and the *P*-value in the following format:

. . . were significantly different (χ^2 = 13.91, df = 26, $P < 0.001$)

. . . were not different (ANOVA: $F = 0.93$; df = 4, 22; $P = 0.46$)

The degrees of freedom for *F*-statistics may also be presented as subscripts:

. . . (ANOVA: $F_{4, 22} = 0.93$, $P = 0.46$)

4.13 When a paper contains a large number of statistical results, a general significance level may be reported in lieu of individual *P*-values:

Values were considered significant at $\alpha < 0.05$.

P-values are not required in abstracts or in conjunction with references to results in cited works:

Smith (1998) found a significant correlation between. . . .

NOTE ON THE GENERAL LINEAR MODEL[1]

4.14 The term "general linear model" encompasses several statistical methods, including linear regression, analysis of variance, and analysis of covariance, in which the errors are distributed normally.[2] For this reason, merely alluding to the general linear model doesn't provide an adequate description of the analyses performed. In particular, it is important to indicate (1) whether the analysis incorporates random as well as fixed effects and (2) whether the variables are continuous or categorical.

A fixed-effects analysis focuses on the particular factor levels or blocks included in the analysis (e.g., the relative abundance of fish in a particular set of streams, where stream is treated as a block), while controlling for other factors. By contrast, a "mixed" analysis includes both fixed and random effects by treating the blocks as being randomly selected from the set of all possible blocks (e.g., treating the sampled streams as a representative subsample of all the streams in the region of interest), again controlling for other factors.

A variable is said to be "continuous" when the data are ungrouped (e.g., fish weights), "categorical" when they are grouped (e.g., male or female, or treated or untreated). An analysis with continuous variables gives insights into overall patterns (e.g., a regression trend); an analysis with categorical variables gives insights into differences among groups.

Note that some variables, such as fish age or year of sampling, may be treated as either continuous or categorical depending on the hypothesis in which one is interested, thus emphasizing the need to specify exactly how the general linear model was constructed. However the analysis is presented, the overall goal is to give readers enough information to replicate the procedure.

[1] The Publications Department thanks Daniel Hayes for his contributions to this section.

[2] The general linear model is thus different from the general*ized* linear model, which can accommodate nonnormally distributed errors.

5. *Numbers and Measurements*

NUMBERS

Word or Numeral?

5.1 As a general rule, spell out numbers less than 10 unless they are used with units of measure:

four anglers 12 boats
4 cm 7 weeks

Note that counts (e.g., numbers of fish) are not considered measurements:

six white bass *not* 6 white bass

EXCEPTIONS

5.2 Always spell out numbers at the beginning of a sentence; if they are used with units of measure, spell out those units as well:

Twelve repetitions were. . . . Ninety-five days later, . . .

5.3 Spell out numbers less than 10 that are used with units of measure (as well as the units of measure) when there are intervening words:

five rainy days seven or more centimeters

5.4 Spell out numbers less than 100 when they modify a compound adjective that contains a number:

ten 30-cm fish *but* 105 30-cm fish

5.5 Use numerals for all numbers that apply to the same or similar items when any of those numbers are greater than 9 and they occur in close proximity to one another:

4 rainbow trout and 12 striped bass from 5 to 20 anglers 2–20 ponds

5.6 Use numerals for numbers used as numbers or designating items in a sequence:

The index ranges from 1 to 5. Outcomes were coded 0 or 1.
experiment 2 tank 3

Precision

5.7 Give the same number of digits for numbers stemming from the same set of measurements or calculations:

5.73–6.10 cm *not* 5.73–6.1 cm

Numbers with Many Digits

5.8 In text, use commas in large numbers unless they are coefficients or other parameters:

1,234 . . . + 1829 x + . . .

5.9 Use scientific notation for very large or small numbers:

3.4×10^{6} 1.94×10^{-3}

Note that it is acceptable to use the word "million" in a number (e.g., 3.4 million instead of 3.4×10^{6}). Avoid using the words "billion" and "trillion," however, because they have different meanings in different countries (e.g., 1 billion is 10^{9} in the United States but 10^{12} in the United Kingdom).

Decimals

5.10 Use a leading zero with decimal numbers less than 1.00:

0.05 *not* .05

Fractions

5.11 In text, spell out fractions:

one-third three fifty-fifths forty-two hundredths

Ordinal Numbers

5.12 Treat ordinal numbers the same as cardinal numbers, but spell out units of measure:

third day fifth hour 22nd day 15th repetition
every 10th meter third-order stream

Use the abbreviations “st,” “nd,” “rd,” and “th” to denote ordinal numbers; these should be set on the same line as the numeral:

11th *not* 11^{th}

Dates and Time

5.13 Either the U.S. or the European convention may be used for dates provided that the usage is consistent:

March 29, 2002 *or* 29 March 2002

Note that in text a comma follows the year in the U.S. convention but not in the European convention:

With respect to mortality, August 11, 1999, was the peak day.
but With respect to mortality, 11 August 1999 was the peak day.

Commas should not be used when only the month and year are given:

June 2001 *not* June, 2001

5.14 Time should always be given in terms of the 24-hour clock:

0800 hours 1545 hours

Note that the plural “hours” is always used and that it is never abbreviated:

0030 hours *not* 0030 hour *or* 0030 h

MEASUREMENTS

English or Metric Units?

5.15 The term “metric units” refers to the units of measure included in the International System of Units established in 1960.

Metric units must be used in AFS books and *Fisheries* as well as in *Transactions of the American Fisheries Society* and the *Journal of Aquatic Animal Health*. Either English or metric units may be used in the *North American Journal of Fisheries Management* and the *North American Journal of Aquaculture* as long as one set of units is used consistently.

A list of acceptable units is given on the page entitled “Symbols and Abbreviations” in the back of each journal.

EXCEPTIONS

5.16 English units may be used in lieu of metric units when the English measure is the one most commonly used, as is frequently the case with construction materials and some pieces of equipment. To the extent that it is practical, provide a metric equivalent or conversion factor:

¼-in (0.635-cm) screw 100 hp (1 hp = 746 W)

5.17 Units may be mixed when this is the common practice:

grams of medication per pound of feed (g/lb)

Abbreviations

5.18 In text, units of measure are generally abbreviated (unless there is no abbreviation) when preceded by a number and spelled out otherwise:

3 km *but* a few kilometers
7 g *but* measured in grams

Lists of acceptable abbreviations appear at the back of each journal and at the front of all symposium proceedings. Other abbreviations may be used but must be defined at the first occurrence.

The following units are always spelled out:

acre ton year month week

Note that there are no separate plural forms for abbreviated units of measure:

1 km 8 km

5.19 Units of measure that stand alone may be abbreviated when they appear in parenthetical expressions:

Fish were weighed (g). . . .
but Fish were weighed to the nearest gram. . . .

5.20 Avoid mixing words and abbreviations:

six boats per day *or* 6 boats/d

not

six boats/d six boats per d *or* 6 boats per day

Note that “6 boats/d” is acceptable even though the first term would ordinarily be expressed as “six boats.”

Operators

5.21 In text, operators such as =, >, and < may generally be used only in parenthetical expressions:

Trophy length fish (>380 mm). . . .
but Trophy length fish, which are those exceeding 380 mm in length, . . .

Important exceptions to this rule are values expressed as means plus or minus standard deviations and those defining statistical significance:

Fish weighed 2.9 ± 0.35 kg.

Values were deemed significant at $\alpha \leq 0.05$.

Space is required around operators when the term in parentheses expresses a complete thought:

(length ≤ 10 cm) *but* length (≤10 cm)

Sequences and Ranges

5.22 The unit of measure should be given only once if the measurement is written with a space between the number and the unit of measure:

from 6 to 10 mm in length 5, 6, or 7 mm in length

If the measurement is written with no space between the number and the unit of measure, the unit should be repeated when there are only two measurements but given only once when there are three or more:

between 2% and 4% *but* 5, 6, and 7%, respectively

5.23 Ranges may be expressed in any of the following ways:

from 72 to 84 s between 72 and 84 s 72–84 s

not from 72–84 s

Note that the rule for repeating units of measure is analogous to that in section 5.22:

between 10°C and 12°C *but* 10–12°C

Monetary Values

5.24 Indicate the national currency the first time a monetary value is given:

US$50,000 Can$25,000

Consult the current edition of *Merriam-Webster's Collegiate Dictionary* for other currencies and their abbreviations.

Ratios

5.25 Certain ratios are expressed by a colon:

(1:3, male : female) 12 h light : 12 h dark

strontium : calcium Sr:Ca

Note that there should be spaces around the colon when it is either preceded or followed by a whole word.

5.26 More commonly, ratios are expressed by forward slashes:

4.29 mg/L

When there is more than one term in the denominator, negative exponents may be used instead of slashes:

$15\ g \cdot m^{-2} \cdot d^{-1}$

To prevent an expression from becoming unwieldy, it may be preferable to rewrite it:

$15\ g/(m^2 \cdot d)$ *or* $15\ g/m^2$ daily

Whichever form is used, be especially careful to avoid ambiguity in such ratios (e.g., $15\ g/m^2 \cdot d$, which could be interpreted as $15\ g \cdot d/m^2$).

Concentrations

5.27 At first mention, concentrations should be stated precisely:

1 μg of gentamicin/mL of water *not* 1 μg/mL gentamicin

After the first mention, a shortened form may be used:

1 μg/mL

A similar rule applies to the use of the term "solution":

in a 10% solution of formalin *not* in 10% formalin

5.28 When metric units are required, parts per thousand, parts per million, and parts per billion should be expressed as in the following table, depending on whether the concentration refers to weight per unit of volume, weight per unit of weight, or volume per unit of volume (note that 1 L of water weighs 1 kg):

Concentration	Weight : volume	Weight : weight	Volume : volume
Parts per thousand	g/L (mg/mL)	g/kg (mg/g)	mL/L (μL/mL)
Parts per million	mg/L (μg/mL)	mg/kg (μg/g)	μL/L (nL/mL)
Parts per billion	μg/L (ng/mL)	μg/kg (ng/g)	nL/L (pL/mL)

5.29 Salinity, which is usually measured as parts per thousand, should be expressed by means of the per mille symbol (‰):

Seawater has a salinity of 30–33‰.

5.30 Blood volumes, which are usually measured in cubic centimeters (cc), should be expressed in milliliters (1 cc = 1 mL); deciliters (1 dL = 10 mL) are also acceptable.

River Kilometers

5.31 Locations along a river are usually stated in terms of the number of river kilometers from a given point:

> At river kilometer (rkm [*or* RKM]) 95 of the Ohio River (measuring from its confluence with the Mississippi River), . . .

Note that the term "river kilometer" must be spelled out at first mention and that the "origin" (i.e., the 0-rkm point) must be stated.

Distance traveled along a river should be stated in terms of kilometers alone:

> We moved 4 km upriver [e.g., from rkm 95 to rkm 99] to the next sampling site.

6. *Punctuation*

By and large, AFS publications follow the *Chicago Manual of Style* in matters of punctuation. This chapter is primarily concerned with (1) areas in which AFS style differs from that in the *Chicago Manual* and (2) situations that tend to cause difficulty for authors.

PUNCTUATION MARKS

Colons

6.1 When emphasis is desired, a colon may be used to introduce a secondary clause that is closely related to the main clause:

This approach often leads to a serious problem: noncomparable data.

The results are quite clear: recruitment is a function of stream temperature.

Note that the secondary clause need not be complete and that the first word is not capitalized even when the clause is complete.

6.2 A colon may also be used to introduce a list, provided that it does not come between a verb and its object(s) or after an expression like "such as" and "namely":

The following treatments were administered: x, y, and z.

The treatments were x, y, and z. *not* The treatments were: x, y, and z.

Certain substrates were preferred: sand, gravel, and cobble.

Certain substrates were preferred, namely, sand, gravel, and cobble.

6.3 In scientific papers, colons are often used to indicate ratios (see section 5.25):

strontium : calcium Sr:Ca 1:1

12 h light : 12 h dark

Commas

6.4 Commas should be used after each item in a series of three or more items:

egg, alevin, and fry stages *not* egg, alevin and fry stages

6.5 With the exception noted in section 6.7, commas should be used after long introductory phrases:

After an acclimation period of 72 h, the fish. . . .

They may be omitted after short introductory phrases, however:

One week later the fish. . . .

By 1999 the situation had changed.

6.6 With the exception noted in section 6.7, commas should be used to separate independent clauses that are joined by the words "and," "but," "for," "or," "so," and "yet":

Previous research suggested that survival was density dependent, and our findings strongly support that conclusion.

Commas should not be used when one clause shares its subject with another clause:

We collected additional data and performed an analysis of variance on the expanded data set.

6.7 Commas should not be used after introductory phrases that are associated with the second independent clause in a compound sentence or to separate independent clauses with a common introductory phrase:

Specimens were obtained by gill netting, and although the samples were not as large as expected they were adequate for our purposes.

At the laboratory, DNA samples were extracted from the fish and electrophoresis was performed to determine whether the populations were genetically distinct.

6.8 Semicolons should be used instead of commas to separate independent clauses that are joined by one of the following adverbs:

also	anyway	besides	consequently
finally	furthermore	hence	however
incidentally	indeed	instead	likewise
meanwhile	moreover	nevertheless	next
otherwise	still	then	therefore
thus			

Tests showed no significant differences between groups 1 and 2; therefore, these groups were pooled in subsequent analyses.

6.9 Commas may be used with appositives and material of a parenthetical nature:

The dependent variable, y_t, was defined as. . . .

The study area, which comprises all or part of three administrative districts, . . .

In some cases, however, it may be preferable to put such material within parentheses per se.

Ellipses (Dots)

6.10 Ellipses are used to indicate omissions in quotations:

"Fisheries management draws on bioenergetics, genetics, . . ., and other specialties."
"This finding was considered definitive. . . ."

Note that the dots are separated by spaces and that four dots are used when the omission occurs at the end of a sentence.

Em and En Dashes

6.11 In text, em dashes may be used to emphasize material of a parenthetical nature as long as such use is sparing:

Determining the toxicity to fish—the principal goal of the experiment—was problematical.

6.12 The principal use of en dashes is to indicate a range of numbers or other sequential items:

6–10 mm May–July 1996

Note that hyphens are used with nonsequential numbers:

Project 83-465

6.13 In AFS publications, en dashes are also used as a replacement for "and," "to," and "at" in compounds:

Beverton–Holt length–weight relationship University of Wisconsin–Madison

Hyphens should be used in compounds not involving "and," "to," or "at":

length-frequency analysis [i.e., of the frequency distribution of lengths]
Smith-Root [compound name]

Forward Slashes

6.14 In ordinary text (as opposed to mathematical expressions and special symbols), a forward slash is equivalent to the word "or." It may be used in AFS publications provided that the term is spelled out at first use:

morbidity or mortality *then* morbidity/mortality

It should never be used as a substitute for the word "and," however:

lakes and rivers *not* lakes/rivers

Hyphens

6.15 Hyphens are used primarily in (1) compound words, (2) compound names, (3) grant and project numbers, and (4) chemical names:

gill-net fishery clear-cut areas *P*-value

Cavalli-Sforza

grant GB-6708 Project FWS-97-12

glucose-6-phosphate dehydrogenase 2,4-D

See Chapter 10 and Appendix A for additional information on the use of hyphens in compound words; see sections 6.12–6.13 for situations in which en dashes are used instead of hyphens.

Parentheses

6.16 Parentheses may be used to provide subsidiary information or indicate the equivalence between terms:

> Our goal (in addition to bringing the existing time series up to date) was to obtain more detailed data on striped bass.
>
> Fish without this genetic marker (hereafter, "strays"). . . .

Parentheses are particularly useful in long or complex sentences.

Semicolons

6.17 The most common use of semicolons is to connect closely related clauses:

The finding of . . . was highly unusual; as a result, we. . . .

See section 6.8 for additional information on this use of the semicolon.

6.18 Semicolons may also be used to separate items in a list when the items are numerous or contain commas:

> We obtained fish samples from the following reaches (indicated by river kilometers): 67–73, which is free-flowing; 47–51, which is impounded by the dam; and 6–11, which is largely regulated by dam operations.

6.19 In AFS publications, semicolons are also used to separate citations and to group items in parentheses logically:

(Smith 1999; Thompson 2001)

($F_{1,29} = 7.98$, $P = 0.034$; Table 1)

USE WITH QUOTATION MARKS, ITALICS, AND BOLDFACE

6.20 In expressions involving quotation marks, periods and commas are always placed inside the quotation marks and colons and semicolons are always placed outside of them. Dashes, question marks, and exclamation points are placed inside the quotation marks when they are part of the quoted material and outside when they apply to the entire sentence (see the examples in section 7.4)

6.21 Punctuation marks should be in ordinary type even when they come immediately after terms in italic or boldface type:

. . . populations of rainbow trout *O. mykiss*, which. . . .

. . . the variance–covariance matrix $\mathbf{X'X^{-1}}$.

LISTS

Lists of the variables in a mathematical expression are dealt with in section 4.8.

Other lists may either be run into the text or set off from it in one or more columns. In either format, the items must be grammatically the same (e.g., all nouns, verbal phrases, complete sentences, and so forth). The items may be numbered if this facilitates comprehension, but letters and bullets may not be used.

6.22 A run-in list forms a natural part of a sentence:

> The study had three goals: (1) to determine overall species richness in the lower portion of the river, (2) to determine the distribution of individual species by habitat type, and (3) to identify any changes in species richness and distribution since the construction of the dam.

Run-in lists are most appropriate when the number of items is small. If numbers are used, they should be enclosed in parentheses; semicolons may be substituted for commas when there are commas within the items themselves (see section 6.18).

6.23 A column (or vertical) list is introduced by a complete clause and generally followed by a colon. The format of the list itself varies according to the length and complexity of the items in it. Simple lists require no numbering or punctuation:

> The student volunteers were asked to bring the following:
>
> rain gear
> a change of clothing
> insect repellent
> . . .

Note the blank line after the lead-in.

More complex lists should be numbered:

> Four management recommendations emerge from this study:
>
> 1. Increasing the minimum length limit
> 2. Shortening the fishing season
> . . .

Note that the numbers are followed by periods and that the first letter of each item in the list is capitalized.

If the items in a vertical list are an integral part of the sentence, they should be separated by semicolons with a period after the last one:

> The procedure consists of
> 1. sampling the entire length of the creek right after ice-out;
> 2. sampling the shallower portions during the spring spawning season; and
> 3. sampling the deeper portions in late summer.

Note that in this case there is no blank line after the lead-in and that the first letter of each item is not capitalized.

7. *Quotations*

FORMAT

7.1 Quotations of three printed lines or less should be placed directly in the text and indicated by double quotation marks:

> Smith (2000) found "a significant degree of hybridization" among the fish at this location.

7.2 Quotations of more than three printed lines should be set as block quotations that are separated from the text (copy editors should identify them as block quotations and mark them to be indented and set in smaller type [e.g., 8/9.5 when the text is 9/11]):

> Thompson et al. (1999:57) reported that
>
> > [t]he incidence of parasitic infection was significantly ($P < 0.05$) greater in brown bullheads *Ameiurus nebulosus* from Hopkins Pond than in those from the Schuylkill River. However, the relationship between pollution and parasitic infection was unclear in the small samples that were taken.

Note that such quotations are "run into" the text and punctuated accordingly.

Citations for block quotations may also be put in brackets at the end; see section 8.10 for an example.

PUNCTUATION

7.3 Place periods and commas inside quotation marks, colons and semicolons outside.

7.4 Place dashes, question marks, and exclamation points inside quotation marks when they are part of the quoted material, outside when they apply to the entire sentence:

> Many researchers have asked the question, "How do we proceed in the face of such uncertainties?"
>
> How should fisheries biologists "sample efficiently"?

Note that no period is necessary in the first example.

SPECIAL USAGE OF WORDS

7.5 Words used as words or in an unusual context may be put within double quotation marks (not italics or single quotation marks):

> The term “eutrophic” generally refers to waters with excess nutrients.
> These XX “males” were then allowed to breed with normal females.

8. *References*

8.1 AFS publications use the author–date system for references, with brief parenthetical citations in the text and full references in an alphabetical list at the end:

Text:	. . . similar findings (Gorman and Karr 1978).
	Mills (1989) states that. . . .
Reference list:	Gorman, O. T., and J. R. Karr. 1978. Habitat structure and stream fish communities. Ecology 59:507–515.
	Mills, D. H. 1989. Ecology and management of Atlantic salmon. Chapman and Hall, London.

CITATIONS IN TEXT

Arrangement

8.2 When there is more than one citation for a particular statement, list them (1) chronologically, beginning with the oldest (with "in press" and "unpublished" sources at the end), and then (2) alphabetically within years (with citations containing "and" and "et al." in alphabetical order):

(Roberts 1985; Johnson 1987; Berger, in press)
(Eldridge 1989; Smith 1992; Smith and Thomas 1992)

Exception: Group publications by the same author or authors together, even if this violates the rule about chronological listing:

(Roberts 1992, 1997; Smith 1996)

8.3 Use lowercase letters to distinguish multiple publications by an author or authors in the same year:

(Hansen et al.1997a, 1997b)

See section 8.46 for the order in which such publications should appear in the reference list and the assignment of lowercase letters to them.

Special Situations

ABSTRACTS

8.4 Abstracts of papers presented at meetings are not acceptable as references in AFS publications. Such material should be treated as unpublished (see sections 8.13–8.17).

NO DATE

8.5 Publications for which no date is available should be listed before those that are in press:

(Harrison 1987; Stein, no date; Bailey, in press)

REFERENCE NOT SEEN

8.6 When the author has not actually seen the source in question, this must be indicated:

(Berzins 1960, cited by Grande et al. 1978)

PAGE NUMBERS

8.7 Page numbers may be included in a citation when the material referred to would otherwise be hard to locate:

(Zar 1984:286–291)

PAPERS IN THE SAME ISSUE OR BOOK

8.8 When a cited paper is in the same book or issue of a journal as the one citing it, this should be indicated:

(Robson 1991, this volume) (Li and Moyle 1991, this issue)
(Miller and Drake 1991; Smith 1991; both this issue)

PARENTHETICAL MATERIAL

8.9 Additional text may be included with citations:

(see Hayes et al. 2000 for a review)
(e.g., Moseley 1999)

However, care must be taken not to confuse results from the cited source with those from the present paper:

(Table 3; Williams 1990) *but* (Table 3 *in* Williams 1990)

. . . in many salmonid diseases (e.g., whirling disease: Carroll 1998)

The colon in the second example makes it clear that it was Carroll who studied whirling disease rather than the author of the present paper.

BLOCK QUOTATIONS

8.10 The citation for a block quotation may be given either in the text (see section 7.2) or in brackets following the quotation:

> . . . when the salmon are out of season and unfit for use. [From Thwaits 1904.]

TABLE AND FIGURE CAPTIONS

8.11 Citations may appear in table and figure captions with additional text as necessary:

FIGURE 1.—Proportional stock densities for largemouth bass. (Source: Lehman et al. 1987.)

TABLE 1.—Length frequency distributions for principal species at Spirit Lake. (Adapted from Klein 1996.)

SERIES OF REFERENCES WITH THE SAME TITLE

8.12 A series of reports or articles with essentially the same title but different years of publication may be combined in citations and reference lists:

Text:	(USGS 1966–1984)
Reference list:	USGS (U.S. Geological Survey). 1966–1984. Water resource data, Connecticut, water years 1966–1984, 19 reports. USGS, Geological Survey Water-Data Reports CT-66-1 to CT-84-1, Washington, D.C.

UNPUBLISHED MATERIAL

8.13 If the source is either the single author of the present paper or all of several authors, unpublished material may be cited in any of the following ways:

(my [our] unpublished data) (author's [authors'] unpublished data)
(author [authors], unpublished) (data on file)

Note that the same format is used for the first mention and any subsequent ones.

8.14 If the source is one of several authors of the present paper, the permissible formats are as follows:

First mention:	(C. B. Schreck, unpublished) one of us (C.B.S.) (Adams 1986, and unpublished)
Subsequent mentions:	(Schreck, unpublished) (C.B.S., unpublished)

There are a couple of things to note about such citations: (1) when only the author's initials are given, they should be closed up; and (2) in citations like "(Adams 1986, and unpublished)" it is not necessary to include the author's last name or initials before the word "unpublished" but the word "and" is needed to make it clear that there are two citations.

8.15 If the source is not an author of the present paper, the person's affiliation must be given at first mention:

(J. Magnuson, University of Wisconsin, personal communication)

(L. A. Smith, Washington Department of Fisheries, unpublished data)

(J. Hawks, University of Kansas, and N. Lyons, Pennsylvania State University, personal communication[s])

8.16 If the source consists of fewer than four people, all of them should be named; otherwise only the first should be named, along with a descriptive reference to the others:

(V. Ross, B. Reed, and C. Rolls, University of Virginia, unpublished data)

but

(V. Ross and coworkers, University of Virginia, unpublished data) [more than three people]

8.17 Memoranda, internal reports, papers presented at meetings, and similar unpublished material should be cited as follows:

First mention:	(A. H. Townsend, 1983 memorandum to B. H. Baker, Alaska Department of Fish and Game, on sportfishing and placer mining)
	Data of S. L. Abidi (paper read at the American Chemical Society meeting, 1980)
Subsequent mentions:	(Townsend, memorandum) (Abidi, unpublished)

REFERENCE LISTS

8.18 References should be listed alphabetically by authors' last names. If there is more than one reference with the same authors, those references should be listed chronologically.

Smith, R. C. 1992. Spawning patterns in. . . .

Smith, R. C., J. B. Oldham, and W. F. Stone. 1998. Determinants of. . . .

Smith, R. C., and H. Thompson. 1995. Observations on. . . .

Smith, R. C., and H. Thompson. 1997. Additional observations on. . . .

Journals

8.19 The general formats for journals and other professional periodicals are as follows:

Hochachka, P. W. 1990. Scope for survival: a conceptual "mirror" to Fry's scope for activity. Transactions of the American Fisheries Society 119:622–628.

Kennedy, V. S. 1990. Anticipated effects of climate change on estuarine and coastal fisheries. Fisheries 15(6):16–24.

Whenever possible, AFS publications use the journal names given in the latest edition of *BIOSIS Serial Sources* (BIOSIS, Philadelphia).

Note that the issue number (i.e., "6" in the second example) must be included when each issue of the publication is paginated separately, as *Fisheries* was prior to 2006.

CONFERENCE PROCEEDINGS

8.20 Conference proceedings that appear in *BIOSIS Serial Sources* are treated like journals; other conference proceedings are treated like books (see section 8.22).

Ansell, A. D. 1961. Egg capsules of the dogfish (*Scylliorhinus canicula* Linn.) bored by *Natica* (Gastropoda: Prosobranchia). Proceedings of the Malacological Society of London 34:248–249. [journal format]

Hashegan, K., editor. 1978. Proceedings of a national symposium on wild trout management. California Trout, San Francisco. [book format]

Note that in the case of proceedings treated as books the place of publication is the location of the organization sponsoring the conference, not that of the conference itself.

8.21 One frequently cited proceedings, that of the annual meeting of the Southeastern Association of Fish and Wildlife Agencies, generally appears a year or two after the meeting. To avoid confusion, references to this periodical should include the year of the meeting after the volume number:

Ott, R. A. 1987. Cost . . . impoundment. Proceedings of the Annual Conference Southeastern Association of Fish and Wildlife Agencies 39(1985):80–85.

Note that from 1954 to 1975 this organization was known as the Southeastern Association of Game and Fish Commissioners and should be named as such in references (proceedings before 1954 should be treated as unpublished).

Books

8.22 The general formats for books are as follows:

Brönmark, C., and L.-A. Hansson. 1998. The biology of lakes and ponds. Oxford University Press, New York.

Murphy, B. R., and D. W. Willis, editors. 1996. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

G. E. Hutchinson. 1975. A treatise on limnology, volume 1, part 1. Geography and physics of lakes. Wiley, New York.

Note that in titles the only words that should be capitalized are the first word and other words that would be capitalized in ordinary text. The number of pages should not be given.

In publishers' names, nonessential terms such as "Company," "Inc.," and "Ltd" should be omitted.

When the city of publication is well known, the name of the state or country in which it is located should be omitted; see section 8.45 for details.

8.23 When a book has been reprinted without revision, this must be indicated:

Piper, R. G., I. B. McElwain, L. E. Orme, J. P. McCraren, L. G. Fowler, and J. R. Leonard. 1982. Fish hatchery management. U.S. Fish and Wildlife Service, Washington, D.C. (4th printing, 1989).

Darwin, C. 1859. Origin of species. Reprint 1982, J. W. Burrow, editor. Penguin Books, London.

SPECIAL AFS PUBLICATIONS

8.24 In addition to books, AFS publishes lengthy monographs, symposia proceedings, and other, special publications, references to which are formatted as follows:

Waters, T. F. 1995. Sediment in streams: sources, biological effects, and control. American Fisheries Society, Monograph 7, Bethesda, Maryland.

Coutant, C. C., editor. 2001. Behavioral technologies for fish guidance. American Fisheries Society, Symposium 26, Bethesda, Maryland.

P. L. Fuller, L. G. Nico, and J. D. William. 1999. Nonindigenous fishes introduced into inland waters of the United States. American Fisheries Society, Special Publication 27, Bethesda, Maryland.

Note that the number of the monograph, symposium volume, and so forth is sufficient; designations such as "number" and "no." should be omitted.

8.25 The various chapters, divisions, and sections of AFS also publish proceedings and other book-length documents, some of which are part of the Special Publications series and others of which are stand-alone. References to the former are formatted as indicated in section 8.24; references to the latter are formatted as follows:

Howell, P. J., and D. V. Buchanan, editors. 1992. Proceedings of the Gearheart Mountain Bull Trout Workshop. American Fisheries Society, Oregon Chapter, Corvallis.

Esocid Technical Committee. 1992. Synopsis of research and management. American Fisheries Society, North Central Division, Bethesda, Maryland.

Starnes, L. B., editor. 1985. Fish and wildlife relationships to mining: symposium proceedings. American Fisheries Society, Water Quality Section, Bethesda, Maryland.

THE "BLUE BOOK"

8.26 References to the Fish Health Section's "Blue Book" should be formatted as follows:

Mitchell, A., and A. Goodwin. 2004. Centrocestiasis (gill trematode disease). *In* AFS–FHS (American Fisheries Society–Fish Health Section). FHS blue book: suggested procedures for the detection and identification of certain finfish and shellfish pathogens, 2004 edition. AFS–FHS, Bethesda, Maryland.

Chapters within Books

8.27 The general format is as follows:

Lofgren, B. M. 2002. Global warming influences on water levels, ice, and chemical and biological cycles in lakes: some examples. Pages 15–22 *in* N. A. McGinn, editor. Fisheries in a changing climate. American Fisheries Society, Symposium 32, Bethesda, Maryland.

not

Lofgren, B. M. 2002. Global warming influences on water levels, ice, and chemical and biological cycles in lakes: some examples. American Fisheries Society Symposium 32:15–22.

Reports

8.28 Reports that are included in *BIOSIS Serial Sources* (because they are issued as part of a regular series) are treated much as other periodicals:

Everest, F. H., C. E. McLemore, and J. F. Ward. 1980. An improved tri-tube cryogenic gravel sampler. U.S. Forest Service Research Note PNW-350.

8.29 The general format for other reports is as follows:

USEPA (U.S. Environmental Protection Agency). 1986. Quality criteria for water. USEPA, Report 440/5-86-001, Washington, D.C.

May, B., and R. Zubik. 1985. Quantitative. . . . Annual Report to the Bonneville Power Administration, Project 83-465, Portland, Oregon.

For reports by government agencies, use the name of the agency that appears on the title page of the report. When different organizational "layers" appear on the title page, list them from largest to smallest:

U.S. Department of the Interior, National Park Service.

Capitalize terms such as "Final Report" and "Completion Report" that pertain to final, published documents; do not capitalize terms such as "preliminary report" and "draft report," which pertain to what is essentially gray literature. Where relevant, provide project numbers.

FEDERAL AID IN (SPORT) FISH RESTORATION ACT REPORTS

8.30 Reports stemming from projects funded by the Federal Aid in Fish Restoration Act (popularly known as the Dingell–Johnson Act) and its successor, the Federal Aid in Sport Fish Restoration Act (the Wallop–Breaux Act), should be listed as follows:

Anderson, R. 1978. Age . . . Kamloops. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, Projects F-53-R-12, -13, Final Report, Boise.

Zuerlein, G. 1984. Statewide fishing survey. Nebraska Game and Parks Commission, Federal Aid in Sport Fish Restoration, Project F-73-R, Final Report, Lincoln.

Note that the publisher is always the state agency to which the grant was awarded. Study and job numbers may be included after the project number but are not required.

SEA GRANT REPORTS

8.31 A few of the reports stemming from projects funded by the National Sea Grant College Program are listed in *BIOSIS Serial Sources* and should be formatted accordingly. The general format for other such reports is as follows:

Hewett, S. W., and B. L. Johnson. 1987. A generalized bioenergetics model of fish growth for microcomputers. University of Wisconsin, Sea Grant Institute, Technical Report WIS-SG-87-245, Madison.

Kapuscinski, A. R., and L. D. Jacobson. 1987. Genetic guidelines for fisheries management. University of Minnesota, Minnesota Sea Grant College Program, Sea Grant Research Report 17, Duluth.

Note that because the different institutions receiving Sea Grant funds name and number their reports in different ways, there is no standardized nomenclature for these reports.

Legal Documents

FEDERAL LAWS

8.32 There are three stages to the publication of a federal law: (1) upon enactment, it is published as a "slip" law; thereafter, it is incorporated into (2) *United States Statutes at Large*, which is updated annually, and (3) the *United States Code*, which is updated every 6 years. The appropriate reference thus depends on the particular stage of publication:

Fisheries Preservation Act of 1998. Public Law 723, 105th Congress, 2nd session (22 April 1998). [slip law]

Fisheries Preservation Act of 1998. U.S. Statutes at Large 111:1012–1025.

Fisheries Preservation Act of 1998. U.S. Code, volume 36, sections 1876–1884.

In each case the text citation would be as follows:

. . . (Fisheries Preservation Act of 1998) . . .

If the title of the act does not include the year of passage, provide that in the citation and reference:

. . . (National Environmental Policy Act 1970) . . .

National Environmental Policy Act. 1970. U.S. Code, volume 42, sections 4321–4347.

FEDERAL REGULATIONS AND OTHER U.S. OFFICE OF THE FEDERAL REGISTER PUBLICATIONS

8.33 References to the Code of Federal Regulations should be formatted as follows:

USOFR (U.S. Office of the Federal Register). 1987. Good laboratory practice for nonclinical laboratory studies. Code of Federal Regulations, Title 21, Part 210. U.S. Government Printing Office, Washington, D.C.

8.34 References to other items appearing in the *Federal Register* should be formatted as follows:

U.S. Office of the Federal Register. 1983. Establishment of Sonoma County Green Valley Viticultural Area, final rule (T.D. ATF-161). Federal Register 48:125(21 November 1983):52577–52578.

USEPA (U.S. Environmental Protection Agency). 1985. Ambient water quality criteria for dissolved oxygen: freshwater aquatic life. Federal Register 50:10(7 April 1985):15634–15668.

STATE LAWS

8.35 References to codified state laws should be formatted as follows:

Fish Habitat Expansion Act. 2004. Code of Maryland, section 1234.5678.

References to uncodified laws should generally follow the format for federal slip laws (section 8.32), providing enough information to enable the reader to locate the source.

COURT DECISIONS

8.36 References to court decisions should follow standard legal format except that the date should appear right after the name of the case:

Hill v. TVA. 1977. 549 F.2d 1074 (6th Cir.)

The corresponding text citation would be

. . . (Hill v. TVA 1977) . . .

OTHER LEGAL DOCUMENTS

8.37 References to congressional hearings should be formatted as follows:

U.S. House of Representatives (Committee on Interior and Insular Affairs, Subcommittee on National Parks and Public Lands). 1992. Joint oversight hearing on the administration's response to the spotted owl crisis (102nd Congress, 2nd session, March 24).

The corresponding text citation would be

. . . (U.S. House of Representatives 1992) . . .

References to congressional reports should be formatted as follows:

U.S. House of Representatives. 1969. [title of report]. House Report 91-382 (91st Congress, 1st session).

The text citation would be

. . . (U.S. House of Representatives 1969) . . .

References to executive orders should follow the formats for the *Federal Register* (section 8.34) or the *U.S. Code* (section 8.32), depending on their stage of publication.

Comments

8.38 The formats for comments vary somewhat, depending on the treatment in the source journal:

Beschta, R. L. 1982. Comment on "Stream system evaluation . . . ," by M. A. Shirazi and W. K. Seim. Water Resources Research 18:1292–1295.

Vladykov, V. D., and E. Kott. 1982. Comment on Reeve M. Bailey's view of lamprey systematics: Comment. Canadian Journal of Fisheries and Aquatic Sciences 39:1215–1217.

Bailey, R. M. 1982. Comment on Reeve M. Bailey's view of lamprey systematics: Reply. Canadian Journal of Fisheries and Aquatic Sciences 39:1217–1220.

Book Reviews

8.39 References to book reviews should be formatted as follows:

Hubbs, C. 1983. Review of "Handbook of darters," by L. M. Page. Copeia 1983:581.

Magazines and Newspapers

8.40 References to popular magazines and newspapers should be formatted as follows:

Tucker, J. W., Jr. 1985. Sheepshead. . . . Tropical Fish Hobbyist (January):64–65, 68.

Larsen, R. 1986. Forestry and fisheries. Seattle Times (February 9):A21, 27.

Saving the ocean. 2003. Washington Intelligencer (May 21):A30.

Note that individual page numbers are required when the pagination is discontinuous.

Theses and Dissertations

8.41 The general formats are as follows:

Chitwood, J. B. 1976. The effects of threadfin shad as a forage species for largemouth bass in combination with bluegill, redear, and other forage species. Master's thesis. Auburn University, Auburn, Alabama.

Hartman, K. J. 1993. Striped bass, bluefish, and weakfish in the Chesapeake Bay: energetics, trophic linkages, and bioenergetics model applications. Doctoral dissertation. University of Maryland, College Park.

Electronic Publications

8.42 If a book or report is only available online or is available in print form but was accessed online, format the reference as follows:

Baldwin, N. A., R. W. Saalfield, M. R. Dochoda, H. J. Buettner, and R. L. Eshenroder. 2000. Commercial fish production in the Great Lakes, 1867–1996. Great Lakes Fishery Commission, Ann Arbor, Michigan. Available: www.glfc.org/databases/. (September 2000).

The month and year in parentheses indicate when the site was accessed.

8.43 The format for references to sources only available on CD-ROM is as follows:

Clarke, K. D., and D. A. Scruton. 1999. Observations of juvenile Atlantic salmon *Salmo salar* behaviour under low temperatures in an artificial stream. *In* Proceedings of the Third International Symposium on Ecohydraulics (CD-ROM). International Association of Hydraulic Research, Salt Lake City, Utah.

8.44 If a journal is available in print form, use the standard reference format even if you accessed the article online:

Vinson, M. R., E. C. Dinger, and D. K. Vinson. 2010. Piscicides and invertebrates: after 70 years, does anyone really know? Fisheries 35:61–71.

If a journal is only available in electronic form, the format depends on the information given for the individual articles:

Gallagher, M. B., and S. S. Heppell. 2010. Essential habitat identification for age-0 rockfish along the central Oregon coast. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science [online serial] 2:60–72. DOI: 10.1577/C09-032.1

Boakes, E. H., P. J. K. McGowan, R. A. Fuller, D. Chang-qing, N. E. Clark, K. O'Connor, and G. M. Mace. 2010. Distorted views of biodiversity: spatial and temporal bias in species occurrence data. PLoS (Public Library of Science) Biology [online serial] 8(6). DOI: 10.1371/journal.pbio.1000385.

Kimmerer, W. J. 2004. Open-water processes of the San Francisco Estuary: from physical forcing to biological responses. San Francisco Estuary and Watershed Science [online serial] 2(1):article 1.

As suggested by the examples above, references should include as much of the standard information as possible (such as volume, issue, and page numbers) as well as the designation "[online serial]." If a digital object identifier (DOI) is available, that should be included as well.

Patents

8.45 References to patents should be formatted as follows:

> Klesius, P. H., C. A. Shoemaker, and J. J. Evans. 2000. In ovo methods utilizing live *Edwardsiella ictaluri* against enteric septicemia in channel catfish. U.S. patent 6,153,202. February 1, 2000.

When there is an assignee, the name of the assignee should appear before the title of the patent and be followed a comma and the word "assignee."

MISCELLANEOUS MATTERS

Names of Places of Publication

8.46 If the name of the publisher includes a state, province, or country name, do not repeat the name:

Wisconsin Department of Natural Resources, Madison
Australian Museum, Sidney

If the name of the publisher includes a city name, however, that name should be repeated:

Cambridge University Press, Cambridge, UK
Auburn University, Auburn, Alabama

Note that cities in the United Kingdom are followed only by the country name, abbreviated to "UK."

8.47 The names of the following cities need not be followed by a state, province, or country name:

Atlanta	Boston	Chicago	Dallas
Denver	Houston	Los Angeles	Miami
New York	Philadelphia	San Francisco	Seattle
Montreal	Ottawa	Quebec	Toronto
Vancouver			
Amsterdam	Athens	Beijing	Berlin
Bonn	Bucharest	Budapest	Brussels
Buenos Aires	Copenhagen	Dublin	Helsinki
Hong Kong	Jerusalem	Lisbon	London
Madrid	Manila	Mexico City	Moscow
Oslo	New Delhi	Paris	Prague
Rio de Janeiro	Rome	Singapore	Stockholm
Tokyo	Vienna		

Multiple Publications by an Author in a Given Year

8.48 It is not uncommon for there to be more than one reference to a particular author (either individually, with the same coauthors, or with different coauthors) in a particular year. In reference lists, publications by single authors should appear in the order in which they are cited in the text with the lowercase letters "a," "b," and so forth appended to the year of publication.

Publications with more than one author are treated similarly, except that they should appear in alphabetical order by the authors' last names:

Benfey, T., R. S. Thomas, and R. T. Thompson. 1985a.
Benfey, T., G. Williams, and R. T. Thompson. 1985b.

Note that references with more than one author won't necessarily appear right together (e.g., a publication by Benfey and Underwood would come between the two Benfey et al. references in the above example).

See section 8.3 for the citation of such publications in the text.

Non-English Publications

8.49 The formats for publications not (or not originally) in English vary depending on whether the original language uses the Latin alphabet and whether a partial or complete translation is available.

Rodríguez, G. M. 1992. Técnicas de evaluación cuantitativa de la madurez gonadal en peces. [Techniques for the quantitative evaluation of gonadal maturity in fish.] AGT Editor, S.A., Mexico City.

Barach, G. P. 1952. [The significance . . . Black Sea salmon]. Zoologicheskii Zhurnal 31:906–915. (In Russian.)

Li, S. 1980. [Preliminary research . . .]. Journal of Fisheries of China 4(3):275–283. (In Chinese with English summary.)

Krashevski, R. S. 1995. Schooling . . . fishes. Translated from the Polish by H. Mills. Lunker Press, New York.

9. *Species Names*

GENERAL

9.1 In AFS publications, the standard practice is to give the accepted common and scientific names the first time that a species is mentioned in the abstract and text and to use only the common name thereafter. The format for the first mention is as follows:

gizzard shad *Dorosoma cepedianum*

As indicated in subsequent sections, however, there are numerous exceptions to this practice, depending on the particular species in question, the authority for the names, and the frequency with which they are used.

9.2 References to a genus that has already been mentioned may be abbreviated unless they occur at the beginning of a sentence or there is a possibility of confusion (e.g., two or more genera beginning with the same letter):

threadfin shad *D. petenense*

9.3 Where appropriate, genus and family names may be used in lieu of species names:

Lepomis spp. in the genus *Micropterus* ictalurids pikes (family Esocidae)

Note that the abbreviation "sp." refers to a single (unidentified) species within a genus, the abbreviation "spp." to two or more species within a genus.

More general references to living organisms do not require scientific names:

coldwater fishes benthic invertebrates

9.4 As a rule, the full common name should be given at each use:

coho salmon *not* coho

However, if the name is long or used frequently and there is no possibility of confusion, it may be shortened after the first use in each paragraph:

trout [for westslope cutthroat trout]

Alternatively, the general term "fish" may be used in such cases.

9.5 If the first mention of a species (apart from any in the abstract) occurs in a table or figure, the scientific name should be given there and not repeated in the body of the text, and vice versa. However, for the sake of completeness, a scientific name that has previously been given in the text may be repeated in a table when the scientific names of other species are first given in that table.

9.6 Scientific names should not be used adjectively unless the alternative is cumbersome:

populations of Chinook salmon *Oncorhynchus tshawytscha*

not Chinook salmon *Oncorhynchus tshawytscha* populations

but Chinook salmon *Oncorhynchus tshawytscha* fry

FISH AND OTHER AQUATIC ANIMALS

Species in AFS's *Names of Fishes*

9.7 AFS is the recognized authority on the names of fishes and a few other aquatic species that are indigenous to North America. The accepted names of these species are given in the publication *Common and Scientific Names of Fishes from the United States, Canada, and Mexico* (Special Publication 29). For species covered by that publication (including exotic species),

- Use the accepted common and scientific names in the abstract and text as indicated in section 9.1; use only the common name(s) in the title
- Use alternative names only if the names committee has endorsed them in the main listings or the notes

Species in Other AFS Taxonomic Publications

9.8 AFS also publishes lists of the names of species for which it is not the primary authority, the most important of which is *World Fishes Important to North Americans* (Special Publication 21). For species covered by those publications,

- Scientific names should be given in the title as well as in the abstract and text
- Common names may be included in the title but are not required
- Alternative common and scientific names are permitted

There are two qualifications with respect to the use of alternative names. First, there should be a bridge to the preferred name in *World Fishes*.

gilthead seabream *Sparus auratus* (also known as gilthead bream)

Second, if an alternative common name is the same as that of another species covered by an AFS publication, the common name should be omitted from the title and abstract and an explanation given in the text:

whitefish *Coregonus lavaretus* (known as powan in North America)

Species Covered by Other Sources

9.9 In the case of names of species not covered by AFS publications,

- Scientific names should be included in the title as well as in the abstract and text
- Common names may be used but are not required

Copy editors should use whatever resources are available (e.g., *Marine Mammals of the World* and Internet searches) to verify the name(s) that the author uses and query the author about any discrepancies.

Special Cases

SUBSPECIES

9.10 At first mention, the names of subspecies are presented as follows:

coastal cutthroat trout *Oncorhynchus clarkii clarkii*

As *Names of Fishes* and *World Fishes* do not give common or scientific names for subspecies, authors will be given a fair amount of latitude in this regard.

DIFFERENT LIFE HISTORIES

9.11 Some fish species have more than one common name because of differences in life history. The most familiar variants are steelhead (the anadromous form of rainbow trout) and kokanee (the lacustrine form of sockeye salmon).

When only one form is mentioned in the paper, it should be presented in the usual way:

steelhead *Oncorhynchus mykiss* kokanee *Oncorhynchus nerka*

When both forms are mentioned, how they are presented depends on which is mentioned first:

rainbow trout *Oncorhynchus mykiss* *then* steelhead (anadromous rainbow trout)

steelhead *Oncorhynchus mykiss* (anadromous rainbow trout) *then* rainbow trout

sockeye salmon *Oncorhynchus nerka* *then* kokanee (lacustrine sockeye salmon)

kokanee *Oncorhynchus nerka* (lacustrine sockeye salmon) *then* sockeye salmon

9.12 Strains are variants that are maintained by culture:

Seneca lake trout *Salvelinus namaycush*

As a rule, copy editors should follow the author with respect to such names. When the strain name does not indicate the species in question, however, clarifying information should be given in the title, abstract, and text. For instance, the title of an article about koi (a variant of common carp) should refer to "koi carp," and the abstract and text should introduce the species by means of a phrase such as "koi, a variant of common carp *Cyprinus carpio*" (after which "koi" alone may be used).

Stocks are populations that are managed as a unit. They usually have geographic names:

Chesapeake Bay striped bass *Morone saxatilis*

If there is any possibility that the stock portion of the name will be considered part of the common name per se, the distinction should be made clear:

Gulf of Mexico population of Atlantic sturgeon *Acipenser oxyrinchus*

Runs consist of members of a species that are migrating to spawn in a particular season:

fall-run [*or* fall] chum salmon *Oncorhynchus keta*

Copy editors should follow the author with respect to stock and run names unless the names used are unclear.

HYBRIDS

9.13 In the abstract and text, the names of hybrids are presented as follows:

tiger muskellunge (muskellunge *Esox masquinongy* × northern pike *E. lucius*)

When the sex of the parents matters, that should be given as well, the female coming first:

sunshine bass (female white bass *Morone chrysops* × male striped bass *M. saxatilis*)

In titles, the common names of hybrids that appear in *Names of Fishes* may be given without indicating the parent species. In other cases involving species named in *Names of Fishes*, the parent species should be given:

saugeye (sauger × walleye)

TAXONOMIC AND SYSTEMATICS PAPERS

9.14 Scientific names may be used throughout such papers, including in the title. Common names should be given in parentheses at the first mention of the species or genus. Scientific names may be used in some places and common names in others if this makes sense in the context of the paper (for an example, see R. F. Stearley and G. R. Smith. 1993. Phylogeny of the Pacific trouts and salmons [*Oncorhynchus*] and genera of the family Salmonidae. Transactions of the American Fisheries Society 122:1–33).

NEW SPECIES

9.15 In the case of a newly described species, the scientific name must appear in the title and may be used in lieu of the common name throughout. Authors will be requested to provide documentation of the name, and the matter will be referred to the chair of the Committee on Names of Fishes for confirmation.

NOTE ON TILAPIA SPECIES

9.16 There are two commonly used taxonomic systems for tilapia species, namely, the Thys and Trewavas systems. Either may be used in AFS publications as long as the usage is consistent:

Thys:	Nile tilapia *Tilapia nilotica*
Trewavas:	Nile tilapia *Oreochromis niloticus*

Note that there are sometimes slight differences in spelling between the two systems:

Thys:	banded tilapia *Tilapia sparrmani*
Trewavas:	banded tilapia *Tilapia sparrmanii*

OTHER SPECIES

9.17 Whenever possible, provide the full common and scientific names of other species mentioned in AFS publications:

Douglas-fir *Pseudotsuga menziesii* double-crested cormorant *Phalacrocorax auritus*

9.18 When there is no common name (as is the case with bacteria and some insects), use the scientific name throughout, abbreviating the genus name after the first use:

Myxobolus cerebralis

When there is no scientific name (as is the case with viruses and cell lines), use the common name or its acronym throughout:

infectious hematopoietic necrosis virus (IHNV)

Chinook salmon embryo (CHSE-214) cells

Note that the scientific name for Chinook salmon is not included in the name of the cell line derived from that species.

Daphnia and Brine Shrimp

9.19 Two common food items of fish—daphnia and brine shrimp—are often not identified beyond the genus level. At first mention, they should be indicated as follows:

daphnia *Daphnia* spp. brine shrimp *Artemia* spp.

Either the common or scientific name may be used in subsequent mentions as long as the usage is consistent:

daphnia *or* *Daphnia*

brine shrimp *or* *Artemia*

If a particular species with no common name is referred to, its scientific name may be used throughout:

A. salina

PLURALS

Fish

9.20 A comprehensive list of the plurals of fish names used in AFS publications is given in Appendix C. The principles governing the formation of these plurals are as follows:

As in other matters pertaining to spelling, the general authority in this area is *Webster's Third New International Dictionary* (as updated by the current edition of *Merriam-Webster's Collegiate Dictionary*).

The vast majority of fish names form their plurals by adding *s* or *es*, with stem changes where required:

bluegills (*not* bluegill) guppies ciscoes

This is especially true for compound names:

walleyes alewives *but* steelhead yellowtail

In a few cases, the plural is the same as the singular (note that this is not a complete list):

trout bass salmon grouper minnow

In the following seven cases, more than one plural is acceptable:

Dolly Varden(s) drum(s) kokanee(s) ruffe(s) sculpin(s) sturgeon(s) tilapia(s)

The usage should be consistent, however.

9.21 When a plural refers to more than one species (as distinct from more than one individual of the same species), it should be formed by adding *s* or *es*:

coho and Chinook salmons [i.e., coho salmon and Chinook salmon]

rainbow and cutthroat trouts [rainbow trout and cutthroat trout]

Other Species

9.22 By and large, the principles given above also pertain to the plurals of species other than fish. Authors will be given a little more leeway, however, especially when more than one form is commonly used.

10. *Spelling and Compound Words*

SPELLING

10.1 The general authority on the spelling of words in AFS publications is *Webster's Third New International Dictionary* (as updated by the current edition of *Merriam-Webster's Collegiate Dictionary*). In some cases, however, sense or the customary usage in the fisheries profession require deviations from the forms given in this dictionary.

See Appendix A for a list of the accepted spellings of words and phrases commonly found in fisheries writing.

Variants

10.2 Use U.S. rather than British spellings.

When the variants have equal weight (indicated by the conjunction "or" in the dictionary), use the shorter one:

totaled *not* totalled

If the variants are the same length, either may be used.

When the variants do not have equal weight (indicated by the conjunction "also"), use the first one regardless of length:

cancellation *not* cancelation

Words with Prefixes

10.3 In general, prefixes should be closed up with the root words to which they are attached:

nonintuitive antioxidant prechallenge

Extensive lists of words with common prefixes may be found in *Merriam-Webster's Collegiate Dictionary*.

EXCEPTIONS

10.4 Use a hyphen after the prefix if the root word is capitalized:

non-Canadian neo-Darwinism

mid-April *but* from mid to late April

10.5 Use a hyphen after the prefix if the word would otherwise be ambiguous or hard to read:

un-ionized cross-sectional multi-institutional
but preexisting microorganism

10.6 Use hyphens when more than one prefix is used with the same root word or the root word is compound:

over- or underrepresented
pre-yolk-sac

non-point-source pollution *but* point source pollution

COMPOUND WORDS

10.7 The spelling of compound words can be tricky; authors should consult the following authorities (in this order) for any such words that they use: (1) Appendix A, (2) *Webster's Third New International Dictionary* (or the current edition of *Merriam-Webster's Collegiate Dictionary*), and (3) the principles given below.

Section 7.90 of the *Chicago Manual of Style* (15th edition) also contains useful examples, though it occasionally deviates from AFS style.

Noun Forms

10.8 In general, compounds that serve as nouns are left open (i.e., with spaces between the individual words) unless the constituent parts are closely linked or the compounds are generally recognized:

main stem open water radio tag
fishpond riverbed seawater

A few technical terms have hyphens, however:

age-class eye-up net-pen

(Note that this is not a complete list of such terms.)

Adjective Forms

10.9 Compounds that serve as adjectives are treated in various ways, depending on the particular form and its position in the sentence.

NOUN–NOUN COMBINATIONS

10.10 Compounds consisting of two or more nouns are usually left open:

age structure differentials sea surface temperatures

However, they may be hyphenated to avoid awkwardness or ambiguity:

population-level analyses

NOUN–VERB PARTICIPLE COMBINATIONS

10.11 Compounds consisting of a noun and a present or past participle are hyphenated:

decision-making authority oxygen-depleted waters

ADJECTIVE–NOUN COMBINATIONS

10.12 Compounds consisting of an adjective and a noun are hyphenated unless the open form is very familiar:

main-stem reaches second-order stream cost-effective measures
but high school participants

COMBINATIONS INVOLVING ADVERBS

10.13 Compounds containing an adverb that ends in "-ly" are never hyphenated:

rapidly changing situation

10.14 With the exceptions noted in section 10.15, compounds containing other adverbs are hyphenated:

well-written article much-replicated research

10.15 Compounds containing "very," "most," and "least" are left open:

very respected scientist least intensive effort

COMBINATIONS INVOLVING UNITS OF MEASURE

10.16 Compounds containing units of measure are hyphenated:

1.5-mg/L treatment

10.17 Compounds that appear after the nouns they modify are left open:

These measures were cost effective. The article was well written.

Verb Forms

10.18 The treatment of compounds that serve as verbs is so irregular that no general rules can be given:

run off break up grow out

dipnet download livetrap

mass-mark PIT-tag air-dry

To determine which form to use, consult the references given in section 10.7.

Use of En Dashes

10.19 In AFS publications, en dashes are used instead of hyphens in compounds in which the en dash stands for “and,” “to,” or “at”:

Beverton–Holt analysis length–weight ratio University of California–Davis

but Smith-Root [official name]

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_0 (the quiescent phase after cell division), G_1 (the primary growth phase), S (the phase in which the genome is replicated), G_2 (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:

P H^+ NH_3 $C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$ + energy

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]
17β-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:

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

18:2(n-6) *or* 18:2(ω-6),

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:

^{14}C *or* carbon-14

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)
Na^+,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 *Hin*c II

Thus, *Taq* is derived from the bacterium *Thermus aquaticus*, *Acc* I is the first enzyme derived from *Acinetobacter calcoaceticus*, and *Hin*c 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 One*μ*3*

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:

C^(T/C)CG(A/G)G

C^T/CCGA/GG

C^PyCGPuG

5'. . .C/(T or C)CG(A or G)G. . .3'

5'-C/(T or C)CG(A or G)G-3'

5' C/(T or C)CG(A or G)G 3'

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.

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

12. *Tables and Figures*

12.1 Because the information that is given in tables and figures usually constitutes the heart of a scientific paper, it needs to be presented in as complete and accessible a way as possible. The general goals are to make tables and figures self-standing (i.e., readily understandable apart from the text) and easy to read.

TABLES

A sample table illustrating many of the points discussed below appears in Example A at the end of this chapter.

Caption

12.2 The first sentence should state the contents of the table in a general way; although many authors simply repeat the column headings in the first sentence, this is not very informative and should be avoided if at all possible. The first sentence does not have to be complete.

Subsequent sentences, which do have to be complete, should present the rest of the information that is pertinent to the table as a whole. Where relevant, this will include

- the particular species involved and their gender(s) and age(s)
- the body of water or laboratory at which the data were obtained (but not the state, province, or country)
- the method by which the specimens were collected (e.g., electroshocking)
- the year and month or season in which the specimens were collected or the experiments carried out
- the statistical tests and significance levels used
- definitions and explanations that apply to the entire table

The following caption, which shows the general format for captions, is a good model:

> TABLE 1.—Seasonal growth and survival (90-d means ± SDs) of age-1 sockeye salmon that were tagged with one of three devices and released into floating net-pens in Lake Genoa, 1987–1988. Asterisks denote significant differences from unmarked controls (*t*-test; $P \leq 0.05$).

EXCEPTION

A complete description of the study need not be repeated in the captions to subsequent tables, provided that the context is clear. For instance, the caption to the table following the one in the example above could be simply

> Table 2.—Relative weights (90-d means ± SDs) of age-1 sockeye salmon in tagging experiments.

12.3 To prevent a caption from becoming unwieldy,

- Move units of measure to the straddle, column, or row headings whenever possible (see sections 12.5–12.7)
- Put narrowly focused definitions and explanations in footnotes
- Do not define terms and abbreviations that are well known and defined in the text (e.g., ANOVA, CPUE)
- When definitions and explanations are lengthy and have been given in a previously mentioned table or figure, refer the reader to that table or figure rather than repeating the information
- When symbol definitions or detailed explanations are readily located in the text, refer the reader to the text

SIGNIFICANCE LEVELS AND STANDARD DEVIATIONS

12.4 If there is one level of significance in a table, it may be noted as in the sample caption above. Different levels of significance are usually indicated by different numbers of asterisks, with an explanation such as the following at the end of the caption:

$$\ldots; P \leq 0.05^{*}, P \leq 0.01^{**}. \quad \textit{or} \quad \ldots (P \leq 0.05^{*}, P \leq 0.01^{**}).$$

Note that a symbol such as *P* may not begin a sentence.

The way in which standard deviations, standard errors, and confidence intervals are presented may be explained in the caption or the row and column headings, whichever is appropriate. The form of the explanation should follow that of the presentation. For example, when the data are presented in the form "9.5 ± 0.7," the explanation should be of the form

$$\text{mean} \pm \text{SD}$$

When the data are presented in the form "9.5 (0.7)," the explanation should be of the form

mean (SD) *or* mean (SDs in parentheses)

Headings

12.5 Column headings may be individual (such as "Age-class" in Example A) or grouped under a straddle heading (such as "Total weight [g]"), as appropriate. Note that a straddle heading describes the items immediately below it, not the data in the columns.

Column headings must apply to all of the information that appears beneath them. When more than one type of information is given, this must be reflected in the heading. For example, if the first column identifies various species of fish for which data are presented and the last row shows means for the data, the column heading should read "Species and mean."

There should be only one set of column headings per table. To avoid having more than one set, rearrange the table (such as by switching the rows and columns) or split it into two or more tables.

12.6 Row headings need not be repeated when they apply to more than one row. Subheadings should be indented the length of one em dash from the main headings.

Bold centered headings (e.g., "Females" and "Males" in Example A) may be used to distinguish types of data. These headings must be distinct from the row headings (i.e., they must not represent larger aggregations of the items in the row headings), and they must not conflict with the column headings.

12.7 If all of the data in the table have the same unit of measure, indicate it in the caption. If different units of measure are involved, indicate them in the appropriate column, straddle, or row headings.

12.8 When the names of months are used in headings, they should be abbreviated to their first three letters; years should be given in their entirety. Date designations such as "6/21/06" are not permitted; use "Jun 21, 2006" or "21 Jun 2006" instead.

12.9 Special rules apply to the capitalization of terms beginning with a number or symbol when they are used in headings.

Capitalize the first word of a hyphenated term unless it involves a unit of measure:

α-Testosterone L-Thyroxine >Age 3 *but* 3-year-old fish 6-week-analysis

Do not capitalize the first word of an unhyphenated term or one in which capitalization would be apt to cause confusion:

1998 year-class % of mean *t*-test

Body

The entries in the body of a table should be arranged so that they are as easy to read as possible. To this end, the press automatically formats these entries according to certain rules. However, there are a few formatting matters for which authors are responsible.

12.10 The press aligns numerical entries on a decimal point (which may not be shown explicitly), an en dash, or a plus/minus symbol (±), depending on the particular form of the data.

12.11 Authors should insert blank lines to divide rows of data into logical groups. Blank lines may also be used to break up long columns of data.

12.12 Authors are also responsible for the correct placement of the lowercase letters that indicate the statistical equivalence of values within a row or column (z, y, . . .); such letters should be put on the same lines as the values to which they refer and be separated from them by single spaces.

Note that the letter z may indicate either the largest or the smallest value(s) but that the other letters must then follow suit (e.g., if z indicates the largest value(s), y must indicate the next largest, and so forth).

Footnotes

12.13 Footnotes should be indicated by superscripts starting with the lowercase letter a. They do not need to be complete sentences but must end with periods. Avoid using footnotes in captions.

Extensions and Continuations

12.14 If a table is too wide to fit on one page, the press will "extend" it onto a facing page, so that column *m* on the left-hand page is followed by column *m* + 1 on the right-hand page. The format for the caption on the right-hand page is

TABLE 1.—Extended.

For clarity, the row headings are repeated on the right-hand page.

12.15 If a table is too long to fit on one page, the press will "continue" it onto a facing page, so that row *n* on the left-hand page is followed by row *n* + 1 on the right-hand page. The format is analogous to that for extended tables except that the column headings are repeated on the right-hand page instead of the row headings.

Appendix Tables

12.16 There is only one difference between tables that appear in appendices and other tables, namely, that the number is preceded by the letter A and a period:

TABLE A.1.—[rest of caption]

Note, however, that all appendices begin with centered headings in bold, even those that only contain tables.

FIGURES

Figures include visual materials such as graphs, maps, diagrams, and photographs. This section outlines the stylistic requirements for figures; authors should also consult the guidelines for the individual AFS publications for specific technical requirements (e.g., electronic format).

Figures have proved to be one of the most troublesome aspects of the publishing process. Although the Publications Department has some ability to revise the figures submitted by authors, figures frequently have to be returned for corrections that could easily have been avoided.

At the most fundamental level, figure design should follow certain commonsense principles: figures should be as simple and straightforward as possible, have a high enough resolution to be easily readable, and be consistent in the use of lettering, line widths, and other graphic elements. They also need to conform to AFS style.

It is particularly important to remember that most figures will be reduced by 35–50% when printed and thus need to be designed with this in mind. Some of the guidelines that follow address this issue, but as a safeguard we urge authors to use a copier to reduce each figure to the width of one or two printed columns and the appropriate height (for the four print journals, the single- and double-column widths are approximately 2.75 and 5.62 in, respectively, and the height 7.25 in; for other AFS publications,

consult the specific guidelines for those publications). Every element should still be legible and all symbols, shadings, and so forth distinct after reduction.

12.17 Captions

Place figure captions immediately after the references, not with the figures themselves. However, outside of the image area on each figure you should provide the corresponding author's name and the number of the figure.

Like the captions for tables (sections 12.2–12.4), those for figures should generally be comprehensive enough to enable the reader to understand the figures without reference to the text. However, to the extent possible, include full variable names, units of measure, panel descriptions, legends, and so forth in the figure rather than in the caption. Identify all abbreviations and nonstandard symbols in the caption.

If symbols such as "A" and "B" are used to designate different panels within a figure, in the caption (1) the letters should be in parentheses, (2) both the letter and the parentheses should be in bold the first time they occur, and (3) the letter should come before the description of the item to which it refers. Capital letters are greatly preferred, but in any case the letters should be exactly the same in the figure and caption (e.g., if the figure uses "a" and "b" rather than "A" and "B," the caption should too).

12.18 Size and Layout

As a rule, figures should be rectangular with a height : width ratio of 2 : 3 or 3 : 4 (unless such a ratio distorts the data). The scale should be chosen so that the representation of the data fills the space allotted to it as completely as possible.

Do not use borders around figures. In figures portraying the (x, y) plane, show only those two axes unless data are also arrayed along a y-axis on the right.

Place tick marks on the outside of the axes (i.e., to the left of the y-axis and below the x-axis).

Place axis labels close to the axes but not so close that they obscure the scale. If an axis label applies to more than one panel above or to the right, it need be given only once (centered with respect to the panels in question).

If the x-axis shows months or years, include the word "Month" or "Year" under the months or years named. Abbreviate months by their first three letters; give all four digits for years.

Place multiple panels close together but do not crowd them. Whenever possible, give them substantive labels (e.g., "Above dam" and "Below dam") rather than "A" and "B."

Place other elements, such as legends (typically used to explain the symbols, line formats, or shading representing different phenomena), scale bars, and compass roses within the margins of the figure; if an element applies to more than one panel, it need be given only once, preferably in the first panel.

Individual lines within a graph may be labeled (such as by an arrow and text, an equation, or statistical information) as long as the graph does not become too cluttered.

Whenever possible, use distinct patterns (e.g., hatch marks) rather than shading to distinguish different phenomena in bar and pie charts; if shading is used, keep it in the range of 30–70% of black and make sure that the different shadings are clearly discernable.

Maps should include a scale and a compass rose indicating which way is north. Highly localized maps should be accompanied by a broader-scale map showing regional location.

12.19 Lines and Lettering

The axis and other lines appearing in a figure should be wide enough to accommodate reduction, but not so wide as to dominate the figure. Different widths may be used to distinguish different items (e.g., axes versus curves), but the same width should be used for analogous items. Special care should be taken with dashed lines (which may appear continuous after reduction) and dotted lines (which may no longer be visible).

Use the font Times Roman for all axis labels; the font size should be 6–9 points after reduction. Other fonts may be used for other items as long as (1) the same font is used for analogous items and (2) the font size is no larger than that used for the axis labels (but at least 6 points).

A bold sans serif font (e.g., Arial) may be used for the letters that distinguish different panels (A, B, etc.). Otherwise avoid bold type, as it tends to fill in when reduced. Also avoid italic type, as it tends to wash out.

Capitalize the first word in all labels as well as any proper nouns and adjectives; do not capitalize other words.

Example A

TABLE 5.—Age, weight, and length statistics for female and male Alabama shad collected in the Choctawhatchee River. Data for years 1994, 1995, 1999, and 2000 are combined.

				Total length (mm)		
	Sample	Total weight (g)			Actual	Model
Age-class	size	Range	Mean	Range	mean	mean[a]
			Females			
2	51	393–990	637	365–438	397	395
3	53	327–1,202	702	365–445	404	408
4	44	360–1,265	772	373–467	418	418
5	13	574–1,118	841	409–455	433	425
6	6	626–963	837	400–440	425	431
			Males			
1	11	48–222	109	90–288	213	207
2	104	48–662	411	188–390	353	357
3	67	80–722	457	222–418	362	370
4	21	313–707	461	344–415	373	371
5	3	409–454	432	362–388	372	371

[a] Model mean is based on the following von Bertalanffy growth models, where $L(t)$ = total length at time t in years. Females: $L(t) = 447(1 - e^{-0.289(t + 5.424)})$; males: $L(t) = 371(1 - e^{-2.437(t - 0.664)})$.

Example B

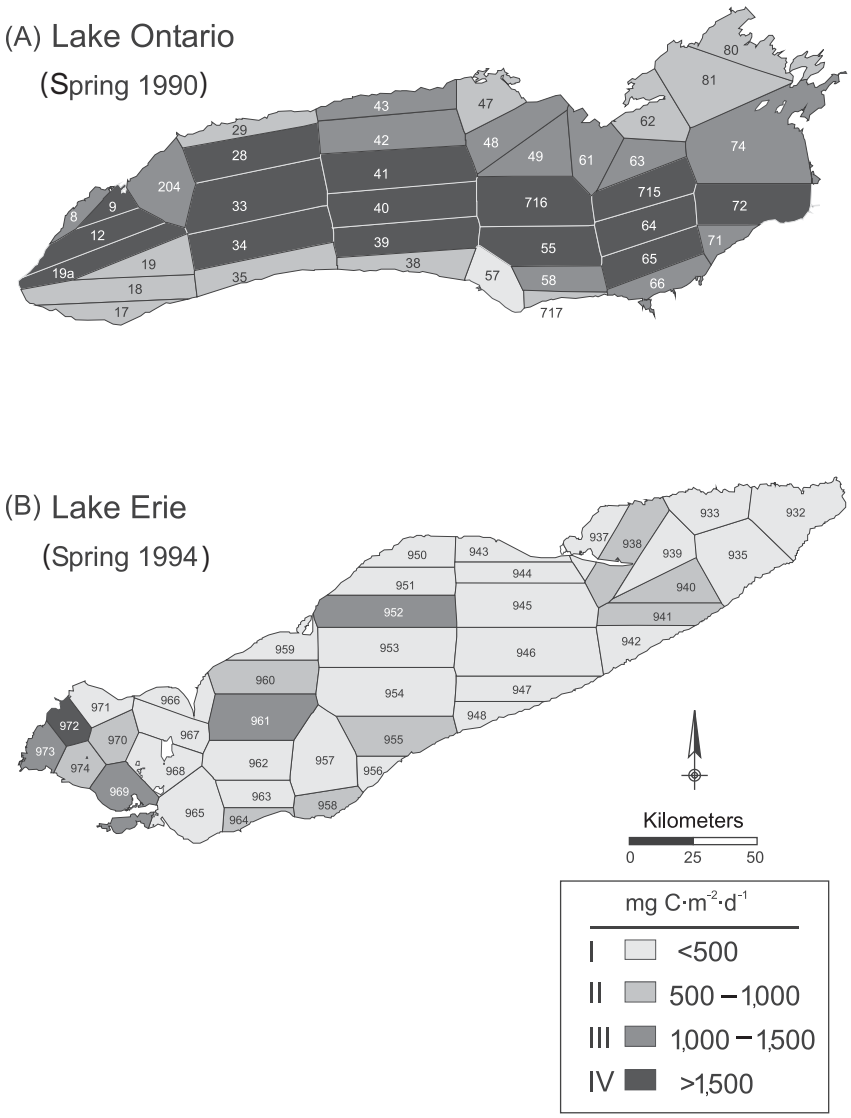

FIGURE 1.—Maps of **(A)** Lake Ontario and **(B)** Lake Erie showing the stations (numbers) sampled on selected synoptic cruises in the springs of 1990 and 1994, respectively; the Thiessen polygons assigned to each station; and the polygons classified according to the level of daily areal phytoplankton photosynthesis computed with cloudless irradiance (mg $C \cdot m^{-2} d^{-1}$).

Example C

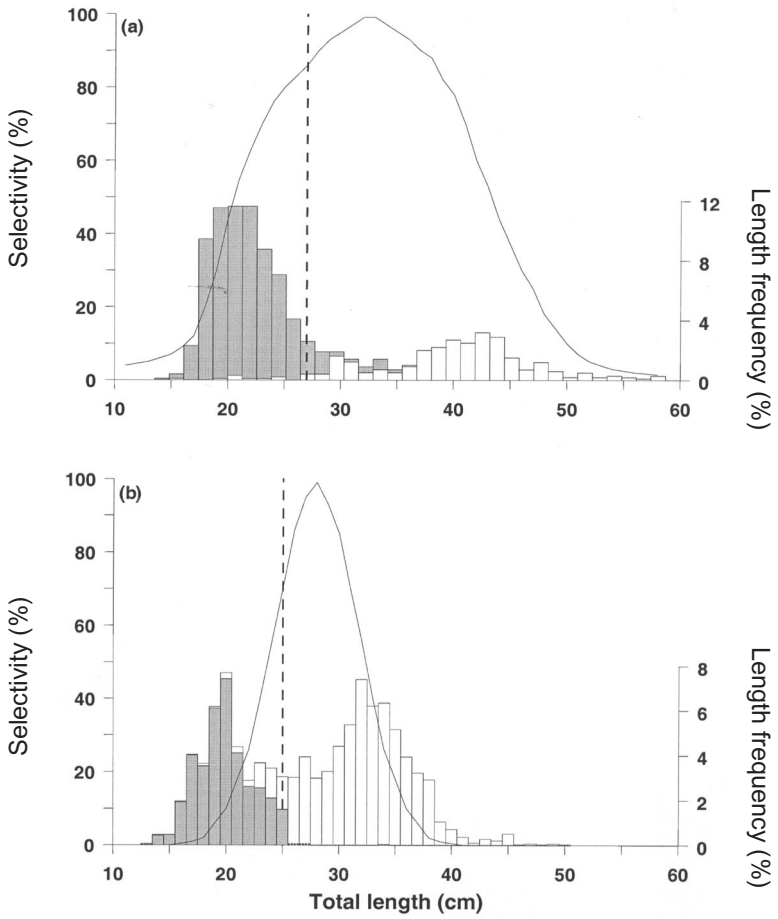

FIGURE 4.—The theoretical overall selection curve for **(a)** *T. toli* from Sarawak and **(b)** *T. macrura* in Sumatra when the selectivity curves for the similarly shaped *T. ilisha* are applied to the mesh sizes used in each fishery. The length frequencies of males (shaded bars) and females (white bars) in the commercial catch and the minimum length at sexual maturity (vertical dashed line) are also shown. Data are from the studies of Blaber et al. (1996, 1999).

13. *Vendors and Commercial Products*

13.1 AFS style gives authors a lot of leeway in referring to the commercial products (feeds, chemical compounds, equipment, and so forth) used in their research. The following formats are all acceptable:

a backpack electrofisher
a backpack electrofisher (Smith-Root)
a backpack electrofisher (Smith-Root; Model 12)
a backpack electrofisher (Smith-Root, Vancouver, Washington)
a backpack electrofisher (Smith-Root, Vancouver, Washington; Model 12)

a Smith-Root backpack electrofisher
a Smith-Root Model 12 backpack electrofisher
a Smith-Root (Vancouver, Washington) backpack electrofisher
a Smith-Root (Vancouver, Washington) Model 12 backpack electrofisher

Terms such as "Inc.," "Ltd.," "Corp.," and "Co." in company names should generally be omitted.

If a commercial product figures prominently in a paper (e.g., when different products are being compared), the names of the product and producer should be given at first mention in both the Abstract and the introduction and a complete identification of the product and producer should be given in Methods:

Eagle's minimum essential medium (Gibco BRL) [Abstract and introduction]

Eagle's minimum essential medium (Gibco BRL, Gaithersburg, Maryland) [Methods]

13.2 Subsequent references to a producer may be shortened:

. . . phosphate-buffered saline (Sigma Chemical Co., St. Louis, Missouri) [first mention]

. . . an enzymatic glucose assay (Sigma) [subsequent mention]

Software

13.3 Software packages should be cited as commercial products or personal communications, whichever applies:

. . . performed with SuperANOVA 4.2 (21st Century Software, Cambridge, Massachusetts).

. . . performed with special software developed by researchers at Utah State University (E. M. Johnson, personal communication; available at www.usu.edu/zool/habsim/).

In the case of personal communications, indicate whether the software is generally available.

U.S. Government Disclaimer

13.4 When one or more of the authors is a U.S. Government employee, the following language should be included in Acknowledgments:

> Reference to trade names does not imply endorsement by the U.S. Government.

14. *Word Usage*

AFS publications restrict the use of certain terms in the interest of technical accuracy and not sounding too colloquial. This chapter reviews these restrictions and addresses other instances of word usage that may cause difficulty.

SPECIFIC TERMS

Affect versus *effect*.—Except in certain psychological contexts, the word "affect" is a verb meaning "to have an effect on"; the word "effect," by contrast, may be either a noun meaning "result" or a verb meaning "to bring about":

The slight change in salinity strongly affected the fish.

The slight change in salinity had a strong effect on the fish.

We effected the change in salinity by adding well water to the tanks.

Alternative versus *alternate*.—The word "alternative" implies other possibilities:

An alternative explanation for the genetic differences that we observed is the founder effect.

The word "alternate" is sometimes used in this sense but more often as a synonym for "opposite" or "every other":

Dipnetters were stationed on alternate sides of the low-head dam.
The fish were fed on alternate days.

And/*or*.—Logically speaking, the expression "x and/or y" is equivalent to "x or y or both," implying that x and y can be taken *either* jointly *or* separately:

Mortality was caused by higher temperatures and/or oxygen depletion.

Even when that is the case, the "or . . . or both" construction is generally preferable.

In most cases, however, "and" or "or" alone is logically correct. For instance,

Wetland use is subject to state and federal regulations.

is more accurate than

Wetland use is subject to state and/or federal regulations.

because even though some wetlands may be subject only to state regulations, some only to federal regulations, and some to both, wetlands—as a group—are subject to both.

And versus *or* in series.—In series, the term "and" should be used to indicate that the items listed are to be taken together, the term "or" that they are to be taken separately:

The treatments used in this experiment were x, y, and z.

but Each fish was subjected to one of three treatments: x, y, or z.

As.—This word may be used to indicate causation:

We terminated sampling early, as the storm had made the lake very choppy.

Bias.—When used as a verb, this word should be accompanied by adverbs rather than adjectives:

biased upward *not* biased high

Compare to versus *compare with*.—There is an important distinction between the expressions "compare to" and "compare with"; to compare one thing *to* another is to indicate that they are similar in some respect, whereas to compare one thing *with* another is simply to examine them side by side:

This situation may be compared to one in which. . . .

We compared the results from the first treatment with those from the second.

In most of the cases encountered in AFS publications, "compare with" is the proper expression. However, it should generally be avoided in actual comparisons:

The fish in the first treatment attained higher weights than those in the second.

not The fish in the first treatment attained higher weights compared with those in the second.

Comprise.—This word should only be used in the active voice; in passive constructions, substitute "composed of," made up of," or a similar term:

The sample comprised fish from 15 species.

but The sample was composed of fish from 15 species.

Confidence interval versus *confidence limits*.—The term "confidence interval" refers to a range of values, the term "confidence limits" to the smallest and largest values within that range:

within the 95% confidence interval 4.9 ± 0.3

within the 95% confidence limits 4.6 and 5.2

Due to.—This term may be used in the sense of "attributable to" but not in the sense of "owing to" or "because of":

The poor recruitment in 1997 is probably due to abnormally high predation.

but Owing to the limitations of our data, we were only able to address the first hypothesis.

Fish versus *fishes*.—The term "fishes" should only be used as a synonym for "species of fish," not as the plural of "fish":

A large number of fishes are found in this ecosystem.

but We collected 422 fish by gill netting.

Fishery versus *fisheries*.—Both terms may be used as adjectives with the same meaning:

Fishery [Fisheries] management is increasingly focusing on angler behavior.

Following.—Avoid using this word as a synonym for "after":

After exposure to the pathogen, the fish. . . .

not Following exposure to the pathogen, the fish. . . .

If versus *whether*.—Use the word "if" only when the intended meaning is "in the event of"; use the word "whether" when stating an indirect question with more than one possible answer:

If hypoxia develops, mortality will rise significantly.

The purpose of this study was to determine whether this type of marking has any deleterious effects on juvenile fish.

Increased/*reduced* versus *higher*/*lower*.—The terms "increased" and "reduced" should only be used in situations in which the researcher has actually altered the variable of interest; "higher" and "lower" should be used in other situations:

The increased temperature in the first two tanks during the second phase of the experiment led to. . . .

The lower average temperature in the more northerly of the two creeks was apparently responsible for. . . .

In order to.—Although in rare cases euphony may call for using this term, in most cases "to" alone will suffice:

To test this hypothesis, we. . . .

not In order to test this hypothesis, we. . . .

Likely.—This word may be used as an adjective but not as a synonym for the adverb "probably":

Early spawning is likely.

Spawning will probably be early.

Over.—This word may be used in the senses of "during" and "more than":

We carried out the research over a period of several months.

Over 500 anglers returned completed survey forms.

Parameter.—Although this word has acquired a number of meanings in recent years, for the sake of clarity AFS style restricts its use to two situations, namely, when it refers to a fixed value in an equation or statistical distribution and when it refers to a critical value of some sort:

The estimated parameters were as follows: $a = -1.33$ and $b = 0.59$.

A relatively high water temperature (≥26°C) is one of the reproductive parameters for this species.

The term "parameter" should never be used when the term "variable" or, more generally, "characteristic" is meant:

The most important variable was streamflow.

Potentially.—Avoid using this term with other terms indicating possibility:

This is a potentially important finding.

not This could be a potentially important finding.

Prior to.—Although euphony may occasionally call for the use of this term, "before" is a better choice in most cases:

Before the start of the experiment, . . .

not Prior to the start of the experiment, . . .

Relationship versus *relation*.—The word "relationship" should be used when referring to an association or causal connection:

the relationship between substrate type and reproductive success

not the relation between substrate type and reproductive success

Significant.—With the exception in the second example below, AFS style restricts the use of this word to cases of statistical significance:

The difference between means was significant ($P < 0.05$).

Though significant statistically, the result was not considered significant biologically.

In other cases, substitute words such as "major," "important," and "substantial" for "significant."

Since.—This word may be used as a synonym for "because" as well as in its temporal sense:

Since the previous research on this question seemed credible, we chose not to replicate it.

Care should be taken to avoid ambiguity, however, as in the phrase

Since the regulations were implemented, . . .

which can be either causative or temporal.

That versus *which.*—As these terms can have different logical implications, AFS style follows the traditional rule of using "that" to introduce dependent clauses and "which" to introduce independent clauses:

The fish that were moribund. . . . [i.e., only some of the fish were moribund]

The fish, which were moribund, . . . [i.e., all of the fish were moribund]

The.—As a rule, the word "the" should be included whenever the statement refers to a particular situation as distinct from a general one:

Channel catfish [in general] are unusual in this regard.

The [particular] channel catfish in our study were unusual in this regard.

However, in the abstract, Methods, and other places in which a more condensed form of expression is desired the word "the" may be omitted from statements referring to particular situations as long as the context is clear:

> We obtained a sample consisting of 298 juvenile Chinook salmon from the Snake River above Hell's Canyon Dam. At the laboratory, fish were weighed (g), measured (mm), and inspected for gross abnormalities. Fish were then randomly assigned to one of three treatments.

Care must be taken when "the" is used with plurals, however. For instance, the statement

The experts in this area have concluded that. . . .

implies that *all* of these experts have reached the stated conclusion, which may not be the case. When it is not, one should state, for instance, that

Some [Many] experts in this area have concluded that. . . .

The word "the" is also required before some place names:

the Atlantic Ocean the Illinois River the Appalachian Mountains

but Antietam Creek Oneida Lake McMillen Reservoir Bonneville Dam Mount Saint Helens

There is/*there are* versus *exists*/*exist.*—Use the more natural "there is" and "there are" instead of "exists" and "exist":

There is conclusive evidence that. . . .

not Conclusive evidence exists that. . . .

Using.—As a rule, AFS style restricts the use of this term to sentences in the active voice in which the agent is clearly specified:

Using a data logger, we obtained data on water temperature.

not Data on water temperature were obtained using a data logger.

Terms such as "by means of" and "with" should be used in passive constructions:

Data on water temperature were obtained by means of a data logger.

While.—This term may be used as a synonym for "although" or "whereas":

While the bluegills were largely unaffected by this change, the white crappies suffered high mortality.

With.—AFS style adheres to the traditional rule prohibiting the use of "with" as a conjunction:

Several species were identified, green sunfish being the most numerous.

or Several species were identified, of which green sunfish were the most numerous.

not Several species were identified, with green sunfish being the most numerous.

OTHER MATTERS

Voice

AFS style permits authors to use the active voice, the passive voice, or a mixture:

We captured 108 specimens in gill nets deployed at three points within the study section. These fish were transported to the laboratory with 4 h of capture and. . . .

Conditional Terms

Conditional terms are ones that express possibilities as distinct from definite facts; examples include the terms "perhaps," "suggests," and "appears to." As a rule, there should be only one such term per sentence:

These results suggest that black crappies are. . . .

not These results suggest that black crappies may be. . . .

Singular versus Plural with Variables

Unless the context clearly calls for a plural, terms referring to variables should be in the singular:

Temperature was recorded at all study sites.

but Temperatures were compared across study sites.

Quantitative Comparisons

Expressions such as

Mortality was four times greater in the second treatment than in the first.

should be avoided because they are ambiguous; logically, the expression "four times greater" means "five times as great," whereas most authors mean "four times as great."

In the same vein, the term "times" should be avoided in describing decreases:

The treatment value was one-fourth that of the control.

not The treatment value was four times lower than that of the control.

Also avoid using vague comparative terms:

Small fish (<78 mm) suffered greater mortality than larger ones.

not Smaller fish suffered greater mortality than larger ones.

Appendix A. *Spelling List*

This appendix shows the treatment of technical terms that are encountered frequently in AFS publications. There are two lists, one for terms relating to mathematics and statistics and one for other terms. Parts of speech are abbreviated as follows: adj = adjective, adv = adverb, n = noun, and v = verb. Superscripted numerals refer to notes at the end of the appendix.

Sources for the second list are abbreviated as follows: W11 = *Merriam-Webster's Collegiate Dictionary*, 11th edition; W3 = *Webster's Third New International Dictionary* (but not W11); CMS = *Chicago Manual of Style*, 15th edition; CBE = *Scientific Style and Format*, 6th edition (Council of Biology Editors, Cambridge, UK); and *FT* = *Fisheries Techniques*, 2nd edition (American Fisheries Society, Bethesda, Maryland). Asterisks indicate terms that are not in either of the two dictionaries, plus signs terms for which AFS's treatment differs from that in these dictionaries.

1. ***Mathematical and Statistical Terms***

analysis of variance (n; adj)
analysis of covariance (n; adj)

arcsine [arcsin in expressions, e.g., arcsin(x + 1)]

arcsine transformation
arcsine-transformed

Bartlett's test
base *e*; base 10 (n)
base-*e*; base-10 (adj)
best fit (n)
best-fit (adj)
Beverton-Holt
Bonferroni *t*-test
bootstrap

Chapman-Robson method
chi-square (*or* χ^2) test (*not* chi-squared test)
coefficient of variation [define as 100 × SD/mean *or* 100 × SE/mean]
cross-classify

detrended correspondence analysis
discriminant function analysis
dome-shaped curve
Delphi technique
Duncan's multiple-range test

$E(x)$ (expected value)
η (eta [amount of variation in a given variable accounted for by ANOVA])
expectation-maximization algorithm
error-prone estimates

Friedman's rank-sum statistic
Friedman's test

Friedman two-way analysis of variance by ranks
F-statistic, -test, -value

general linear model (n; adj)
generalized least squares
G-test, -value
goodness of fit (n)
goodness-of-fit (adj)
growth-invariant discriminant functions

H' (Shannon–Weiner diversity index)
H_0 (null hypothesis)
habitat suitability curves
Hardy–Weinberg expectation
heteroscedastic, -icity
homoscedastic, -icity
honestly significant difference (n; adj)
Hotelling–Lawley criteria
Hotelling's T^2-statistic

Jolly-Seber model
Jonckheere test

Kendall coefficient of correspondence (*W*)
Kendall rank correlation coefficient (τ)
Kendall's tau (*or* τ)
Keuls' test
Kolmogorov D-statistic
Kolmogorov–Smirnov cumulative distribution test
Kolmogorov-Smirnov one-sample test
k-sample binomial test (2 × *k* test)
Kruskal–Wallis *H*-test

Kruskal–Wallis *k*-sample test

least significant difference (n)
least-significant-difference (adj)
least squares (n)
least-squares (adj)
linear discriminant analysis
$\log_e$, $\log_{10}$
logistic regression
log- likelihood function
log-linear
lognormal, -ity
log-transformed (before noun)
log transformed (after noun)

Mahalanobis distance
Mann–Whitney *U*-test
maximum likelihood (n; adj)
mean square error
Monte Carlo
multiattribute utility analysis
multinomial distribution
multiple comparison procedure
multiple correlation (n)
multiple-correlation (adj)
multiple regression (n)
multiple-regression (adj)
multisample single recapture model
multivariate analysis
multivariate analysis of variance

Newman–Keuls
nonlinear least-squares regression
nonuniform probability sampling

one-way analysis of variance

pair-group method
pairwise comparisons
Pearson's product-moment correlation coefficient
Pillai criteria
product-moment correlation
product-multinomial sampling
P-value

r (correlation coefficient)
R^2 (coefficient of multiple determination; r^2 if only one explanatory variable)
rank-sum

Scheffé's statistic
Shannon–Weiner diversity index
Shapiro–Wilk *W*
signed rank
sign test
skewed distribution
Spearman's rank correlation coefficient (r_S)
square-root-transformed data
stratified random design (*or* sampling)
stratified-random-sample model
Strauss's linear index
Student–Newman–Keuls test

time series analysis
t-test
Tukey–Kramer analysis
Tukey post hoc analysis
Tukey's test
two-way analysis of variance
type I (*or* II) error

unweighted pair-group method with arithmetic averages
U-test

Var(*x*) (*or V*[*x*]) (population variance)
var(*x*) (*or* vâr[*x*] or *V*{caret}[*x*]) (sample variance)
variance–covariance

W (Kendall coefficient of correspondence)
Wilcoxon–Mann–Whitney two-sample test
Wilcoxon matched-pairs, signed-ranks test
Wilcoxon rank-sum test
Wilcoxon's signed rank test
Wilks criterion
Wilks' lambda (*or* λ)

x-axis, -coordinate, -intercept

y-axis, -coordinate, -intercept

2. ***Other Terms***

acid-neutralizing (adj)*
acid-tolerant (adj)*
acre-foot; acre-feet (n)[W11]
acre-foot-day; acre-feet-day (n)*
acre-inch (n) [W11]

x at age (n)*
x-at-age (adj)*
age *x* (n)*

age-*x* (adj [before noun])*
age *x* (adj [after noun])*
age-class (n[W3]; adj*) **17**
age-cohort (n; adj) **17**
age-group (n[W11]; adj*) **17**
age structure (n; adj)*
air bladder (n[W11]; adj*) **24**
air-breathing (adj)*
air-dry (adj; v)[W11]; air-dried (adj; v)*
air sac (n)[W11] [in birds only] **24**
air stone (n; adj)*
alongshore (adj; adv)[W11]
ammonia nitrogen *or* NH_3-N (n[W3]; adj*)
ammonium nitrate (n[W11]; adj*)
ammonium nitrogen *or* NH_4^+-N (n[W3]; adj*)
angler data (n; adj)*
angler-day (n)* **19**
angler effort (n; adj)*
angler-hour (n)* **19**
appendices *or* appendixes (n)[W11]
aquaculture[W11] [*not* aquiculture]
artificial intelligence (n[W11]; adj*)
ASCII (n)[W11]

back-calculate (v)*
back-calculated (adj)*
back-calculation (n)*
backwater (n)[W11]
baitfish (n)[W3]
bait line (n; adj)*
bait minnow (adj)*
bank fish (n[W3]; adj*)
bank-full (adj)[W3]
barbed wire (n)[W11]
barbwire (adj)*
bar code (n[W11]; adj*)
base flow (n; adj)*
baseplate (n)[W3]
BASIC (n)[W11]
B cell (n[W11]; adj*)**11**
bed load (n; adj)*
benefit-cost* *or* cost-benefit[W11] (adj)
binary code (n)*
binary-coded wire tag (adj)*
biotelemetry (n)[W11]
blacktail (n)[W3]
bleb-like (adj)* **21**
block net (n)*
block-net (adj)*
blocknet (v)*
block-netter (n)*
block netting (n)*
block-netting (adj)*
blow down (v)*
blowdown (n; adj)[W11]
x boat; *x*boat (n) **18**
bottom fish (n[W3]; adj*)
bottom fishing (n[W3])
box plot (n)*
brackish water (n)[W11]
brackish-water (adj)[W11]
break up (v)[W11]
breakup (n)[W11]
breakwater (n)[W11]
brewer's (adj)[W11]

brood female (n[W3]; adj*)
broodfish (n)*
broodsac (n)[W3]
broodstock (n)+
brood year (n; adj)* **20**
bus route (n; adj)*
bycatch (n)*
by-product (n)[W11]

carbon-14 (n; adj)+ **15**
case history (n[W3]; adj*)
cast net (n)[W3]
cast-net (adj)*
castnet (v)*
catch depletion method [as in *FT*]
catch-release (adj)*
catch and release (n)*
catch-and-release (adj)*
catch per effort *or* catch per unit effort (n)*
catch-per-effort *or* catch-per-unit-effort (adj)*
char (n)[W11] [*not* charr]
charter boat (n)*
charter boat *or* charter-boat (adj*) **18**
charter fishing boat (n)*
chlorophyll *a* (n)[W11]
chlorophyll-*a* (adj)*
clear-cut (n; adj)[W11]
clear-cut (v)*
clear-cutting (n[W11]; adj*)
cobalt-60 (n; adj)+ **15**
coded wire tag (n; adj)*
coded-wire-tagged (adj; v)*
coded-wire-tagging (adj)*
cod end (n[W3]; adj*)

cold brand (n)* **8**
cold-brand (adj; v)*
cold water (n)[W11]
coldwater (adj)+
cold-water disease (adj)*
common property (n)[W3]
common-property (adj)*
compact disc (n)[W11, **23**]
contingent valuation (n; adj)*
cool water (n)*
coolwater (adj)*
cost-benefit (adj)[W11]
coworker (n)[W11]
cove rotenone sampling [as in *FT*]
creel (n; v)[W11]
crosshatch (n; v)[W11]
cross-hatching (n)[W11]
cross-react (v)[W11]
cross-reaction (n)[W11]
cross-reactive (adj)[W11]
cross section (n)[W11]
cross-section (v)[W11]
cross-sectional (adj)[W11]
cross validate (v)*
cross validation (n)*
cut bank (n; adj)*

daphnia (n)[W11] [define as *Daphnia* spp. at first use]
data (n)[W11] [takes plural verb]
database (n)[W11]
data logger (n; adj)*
data set (n)*
x-day **19**

day length (n; adj)*
decision maker (n; adj)* [1]
decision making (n)* [2]
decision-making (adj)* [2]
deep sea (n)[W3]
deep-sea (adj)[W11]
deep water (n)*
deepwater (adj)[W11]
deepwaterman (n)[W3]
degree-day (n)[W11]
Dermo (n)*
desktop (n)[W11]
die off (v)[W11]
die-off (n[W11];adj*)
dip net (n)[W11]
dip-net (adj)*
dipnet (v)[W11]
dipnetter (n)[W3]
dipnetting (n)[W3]
disc brake (n[W11]; adj*)[23]
disk *or* disc (n)[W11, 23]
distiller's (adj)+
D-loop (n, adj)
dome-shaped (adj)*
dorsolateral (adj)[W11]
dorsoventral (adj)[W11] [*not* dorsiventral]
dorsoventrally (adv)[W11]
double-tag (v)*
double-tagged (adj)*
downcurrent
downlake (adj; adv)*
download (v)[W11]
downstream (adj; adv)[W11]

early *x*; early-*x* (adj[W11])[3]
early (adv[W11]) [3]

echolocation (n)[W11]
echo sounder (n[W11]; adj*)
echo sounding (n)*
echo-sounding (adj)*
ecosystem-wide (adj)* [22]
e-mail (n; adj)+
end label (n; adj)*
end-labeled (adj)*
endpoint (n)[W11] (end of line)
end point (n) [W11] (goal)
exvessel (n)* [prevailing usage]
eyed egg (n)[W3]
eyed egg stage (adj)*
eye-up (n; adj)*

family-group (n; adj)*
fax (n; v)[W11]
fieldwork (n)[W11]
field-worker (n)[W11]
filterability (n)[W11]
filterable (adj)[W11]
filter-feed (v)*
filter feeder (n)[W11]
filter feeding (n)*
filter-feeding (adj)*
fin clip (n; adj)*
fin-clipped, fin-clipping (v)*
finfish (n)[W11]
fin fold (n[W3]; adj*) [5]
fin ray (n; adj)*
first-order (adj)[W11, 16]
fish culture (n[W3]; adj*)
fish culturist (n)*
fish farm (n[W11]; adj*)

fish-farm (v)[W11]
fish-farming (n[W3]; adj*)
fish-finder (n)[W3]
fish hatchery (n[W3]; adj*)
fish ladder (n[W3]; adj*)
fishline (n)[W3]
fish meal (n[W3]; adj*)
fishnet (n)[W11]
fishpond (n)[W11]
fishpound (n)[W3]
fishway (n)[W11]
fishweir (n)[W3]
fish well (n[W3]; adj*)
fish wheel (n[W3]; adj*)
floppy *or* floppy disk (n)[W11,**23**]
flowmeter (n)[W11]
flow rate (n; adj)*
fly-fish (v)[W3]
fly fisher (n; adj)+
fly fisherman (n[W11]; adj*)
fly-fishing (n)[W11]
focal point (n; adj)*
*x*fold *or* *x*-fold (fourfold; 14-fold)
food fish (n[W3]; adj*)
footrope (n)[W11] (part of a net)
FORTRAN *or* Fortran (n)[W11]
freeze brand (n; v)* [**8**]
freeze-branded (adj; v)* [**8**]
freeze branding (n)* [**8**]
freeze-branding (adj; v)* [**8**]
freeze-dried (adj)[W11]
freeze-dry (v)[W11]
freeze-drying (n)[W3]
freshwater (n; adj)[W11]

full time (n)[W11]
full-time (adj;adv)[W11]
fyke net (n)
fyke netting
fyke-net (v, adj)

gallbladder (n)[W11]
game fish (n[W11]; adj*)
game fisherman (n; adj)*
game-fishing (n; adj)*
gamma irradiation (n)*
gas bladder (n; adj)* [**24**]
generating station (n)[W3,**4**]
gill net (n)[W11]
gill-net (adj)*
gillnet (v)[W11]
gillnetter (n; adj)[W11]
gill netting (n)*
gillnetting (v)*
gill raker (n[W11]; adj*)
gray (adj)[W11] [*not* grey]
groundfish (n)[W11]
groundfish fishery (n)*
    [preferable to groundfishery]
ground truth (adj)*
ground-truthing (n)*
groundwater (n)[W11]
group *x* [**17**]
grow out (v)[W3]
grow out (n)*
grow-out (adj)*

handline (n; v)[W3]
hard water (n)*
hard-water (adj)*
headboat (n)* [**18**]
headrope (n)[W3]

headstream (n)[W11]
headwater (n)[W11]
herpesvirus (n)[W11]
high sea (n)[W11] (usually plural: high seas)
high-sea (adj)*
high water (n)[W11]
high-water (adj)[W11]
hook and line (n)*
hook-and-line (adj)*
hook-and-liner (n[W3]; adj*) (the boat)
x-hour [19]
hydro (n; adj)[W11] (short for hydropower)
hydro*x*[W11]
hydroelectric (adj)[W11] [*not* hydrogenerating]
hydropower (n)[W11] (= hydroelectric power)

ice melt (n; adj)*
ice-out (n[W11]; adj*)
image-processing (adj)*
index (n)[W11] [plural: indices *or* indexes]
inflow (n)[W11]
inflow (v)[W3]
*x*ing [2]
in-lake (adj)*
in-river (adj)*
inshore (adj; adv)[W11]
in stream (n)*
instream (adj)*
interisland (adj)[W11]
intervertebral disk (n)[W11,**23**]
in vitro (adj; adv)[W11] [not italic]
in vivo (adj; adv)[W11] [not italic]
iteroparous (adj)*

johnboat (n)[W11, **18**]

kick-sampling (n; adj)*
kick-seining (n; adj)*
x-kilometer [19]

lake bed (n[W3]; adj*) [lakebed all right when used with streambed[W11]]
lakefront (n)[W11]
lakeshore (n)[W11]
lakeside (n)[W11]
lake water (n; adj)*
laptop (n; adj)[W11]
large-scale (adj)[W11]
larva (n)[W11] [plural: larvae]
larval (adj)[W11]
lateral line (n[W11]; adj*) [5]
lateroventral (n)* length-cohort (n; adj)* [17]
length frequency (n)*
length frequency *or* length-frequency (adj)* [25]
length-group (n; adj)* [17]
length–weight (adj)* [length and weight]
leukocrite (n)*
leukocyte (n)[W11] [*not* leucocyte]
life cycle (n[W11]; adj*)
life history (n[W11]; adj*)
life-size *or* life-sized (adj)[W11]
life span (n[W11]; adj*)
life stage (n; adj)*
lifestyle (n)[W11]
lifetime (n; adj)[W11]
light pen (n[W11];adj*)
lightproof (adj)[W11]

light stick (n; adj)*
lightweight (n)[W11]
*x*like [21]
limited access (n)*
limited-access (adj)[W11]
limited entry (n)*
limited-entry (adj)*
live-box (n[W11]; adj*)
live-cage (n; adj)*
live trap (n)[W11]
live-trap (adj)*
livetrap (v)[W11]
liveweight (n)[W3]
live well (n)[W3] (live-box for fish)
live-well (adj)*
long-line (v)*
longline (n)[W11]
long-liner (n)[W11]
long-lining (n)[W11]
long-lived(adj)[W11]
longshore (adj)[W3]
long-term (adj)[W11]
longtime (adj)[W11]
low-head (adj)

mainframe (n)[W11]
main stem (n)[W11]
main-stem (adj)*
mainstream (n; adj)[W11]
x maker [1]
x making [2]
mark–recapture (adj)*
mass mark (n)* [9]
mass-mark (v)* [9]
mass-marked (adj)* [9]
mass marking (n)* [9]
mass-marking (adj)* [9]
megalops (n)[W3]
[plural: megalops *or* megalopses][W11]
megalopic (adj)[W3]
meltwater (n)[W11]
microchip (n)[W11]
microcomputer (n)[W11]
microwell plate (n; adj)*
microwire tag (n)*
microwire-tagged (adj; v)*
mid (adj)[W11] or mid- [6]
middepth (n)* [6]
midwater (n+; adj*) [6]
x-mile [19]
minicomputer (n)[W11]
minimum size limit (n)*
minimum-size-limit (adj)*
mixed-stock analysis (n)*
mollusk [preferred] *or* mollusc (n)[W11]
*x*most (adj)[W11]
mother ship (n)[W3]
mother ship *or* mothership (adj)*
motorboat (n)[W11, 18]
mouthbreeder (n)[W11]
mouthbrooder (n)*
mouth-brooding (adj)*
multispecies (adj)[W11]

near shore (n)*
nearshore (adj)[W11]
net-day; net-night (n)* [19]
net-pen (n; adj)*

net plankton (n[W3]; adj*)
network (n; v)[W11]
networking (n)[W11]
neutron activation (n; adj)*
nick translation (n; adj)*
nick-translated, nick translated
[hyphenate before noun; leave open after noun]
nitrate-nitrogen (n)* (NO_3-N)
nitrite-nitrogen (n)* (NO_2-N)
nonangler (n)*
nonnative (n)[W11]
nonnormal (n)*
non-point-source (adj)* **13**
non-yolk-bearing (adj)* **13**
number cruncher (n[W11]; adj*)
number crunching (n)[W11]
number-crunching (adj)*

off-center *or* off-centered (adj)[W3]
off shore (n)*
offshore (adj; adv; prep)[W11]
off-station (adj)*
old growth (n)[W3]
old-growth (adj)*
onboard (adj)[W11]
on site (n)*
on-site (adj; adv)[W11]
open-formula diet (n)*
open water (n)[W3]
open-water (adj)*
optical disk *or* optical disc (n)[W11,**23**]
x-order **16**
out-migrant (n[W11]; adj*)
out-migrate (v)[W11]
out-migration (n[W11]; adj*)
overfish (v)[W11]
overwinter (v; adj)[W11]

Pascal *or* PASCAL (n)[W11]
pattern recognition (adj)*
PC (n)[W11] (personal computer)
[plural: PCs *or* PC's]
percent (n; adj; adv)[W11]
percentage (n)[W11]
Petersen disc (n; adj)*
phone book (n; adj)*
phosphorous (adj)[W11]
phosphorus (n)[W11] (the element)
physicochemical (adj)[W11]
PIT tag (n; adj)*
PIT-tag (v)*
PIT tagging (n)*
point source (adj)*
policymaker (n)* **1**
pond water (n; adj)* (like lake water)
pop net (n)*
pop-net (adj)*
post*x*
poststocking (adj)*
powerhouse (n)[W11]
power plant (n[W11]; adj*) **4**
power station (n[W11]; adj*) **4**
predator-prey (n; adj)*
presmolt (n; adj)*
prey fish (n; adj)*
pre-yolk-sac (adj)* **13**
purse seine *or* purse net (n)[W11]

purse-seine (adj; v)* **10**
purse seiner (n[W11]; adj*)
purse seining (n)[W11]
purse-seining (adj)*
push net (n)[W3]
push-net (adj)*

quasi*x* (adj)[W11]

radio tag (n; adj)* **12**
radio-tag (v)* **12**
radio-tagged (adj; v)* **12**
radiotelemetry (n)[W11, **12**]
radio-track (v)*
radio-tracked (v; adj)*
radio transmitter (n[W3]; adj*)
rain forest (n[W11]; adj*)
rebar (n)[W11]
recirculating
water (adj)
riverbank (n)[W11]
riverbed (n)[W11]
RNase (n)[W11] [*not* RNAase]
rootwad (n)*
R plasmid (n)* **11**
run off (v)[W11]
runoff (n)[W11]

sagitta (n)[W3] [plural: sagittas *or* sagittae]
saltfish (n)*
salt lake (n[W11];adj*)
salt marsh (n)[W11]
salt-marsh (adj)[W3]
salt water (n)[W3]
saltwater (adj)[W11]
seabed (n)[W11]
seafloor (n)[W11]
sea grass (n)[W11]
sea ice (n[W3]; adj*)
sea level (n[W11];adj*)
sea pen (n[W11]; adj*) (an anthozoan)
sea-pen (n; adj)* (type of net-pen)
sea ranching (n)*
sea-ranching (adj)*
sea-run (adj)[W11]
sea-running (adj[W3]; v*)
sea surface (adj)*
seawater (n)[W11]
Secchi disk (n; adj)* [as in *FT*]
second growth (n)[W11]
second-growth (adj)* **16**
second-order (adj)[W3, **16**]
seine (v)[W11]
seine *or* seine net (n)[W11]
seine *or* seine-net (adj)*
seiner *or* seine-netter (n)[W11]
semelparous (adj)*
serum (n)[W11] [plural: sera *or* serums]
setline (n)[W11]
shallow water (n)*
shallow-water (adj)*
shoreline (n)[W11]
short tandem repeat
(n;adj)
short term (n)*
short-term (adj)[W11]
side-scan sonar (n)[W11]
single-nucleotide polymorphism
x-size *or* *x*-sized [usually hyphenated]
size-class (n; adj)*
size-frequency (adj)*
size-group (n; adj)* **17**
size range (n)*

size-selective (adj)* [open after noun]
snowmelt (n)[W11]
sociocultural (adj)[W11]
socioeconomic (adj)[W11]
socioeconomics (n)*
software (n)[W11]
soft water (n)*
soft-water (adj)*
species' [possessive; *not* species's]
species composition (n; adj)*
x-specific [usually hyphenated]
speedboat (n)[W11, **18**]
sport fish (n[W11]; adj*)
sport fisherman (n[W11]; adj*) (the person)
sportfisherman (n)[W11] (the boat)
sport fishery (n; adj)*
sportfishing (n)[W11]
sportfishing (adj)*
spreadsheet (n)[W11]
springwater (n)[W3]
stainless steel (n[W11]; adj*)
starch gel (n; adj)*
state-space (n; adj)
steady state (n; adj)[W11]
stock–recruit (adj)*
stock–recruitment (n; adj)*
stop-log (n)
streambank (n)*
streambed (n)[W11]
streamflow (n)[W3]
streamside (n)[W11]
strip-spawned (v; adj)*
strip-spawning (n; adj)*
superphosphate (n)[W11]
surface water (n; adj)*
surplus production model
swim bladder (n[W11]; adj*)[**24**]
swim-up (n; adj)*

tag-release (n; adj)*
tailwater (n)[W11]
tap water (n[W11]; adj*)
T cell (n; adj)[W11, **11**]
thin section (n)[W3]
thin-section (v)*
third-order (adj)[W3, **16**]
tidewater (n)[W11]
timesaving (adj)[W11]
time series (n[W11];adj*)
tow net *or* towing net (n)+
townet (v; adj)*
trapline (n)[W11]
trap net (n)[W3]
trap-net (adj)*
trap- netted (v)*
trap-netting (n; v)*
travel cost (n; adj)*
T wave (n)[W3]
T-wave (adj)*
type *x*; *x*-type[**17**]
type A (adj)[W11, **17**]
type species (n[W11]; adj*)

un-ionized (adj)*
uranium-235 (n; adj)+[**15**]

video camera (n)*
video-camera (adj)*
videocassette (n)[W11]
videodisc (n)[W11, **23**]

videotape (n; v)[W11]
video terminal (n)*
virus-like (adj)* [21]
vitamin *x* (adj)
vitamin-C-free diet

warm water (n)[W3]
warmwater (adj)[W3]
wastewater (n)[W11]
waterborne (adj)[W11]
water column (n[W3]; adj*)
water-hardened (adj; v)* [before and after noun]
water hardening (n)*
water-hardening (adj)* [before and after noun]
waterpower (n)[W11]
water quality (n; adj)*
water year (n; adj)* [20]
weigh in (v)[W11]
weigh-in (n)[W11]
weight frequency (n)*
weight frequency *or* weight-frequency (adj)* [25]
weight-length (n; adj)*
well-being (n)[W11]
well-known (adj)[W11] [before and after noun; *but* very well known (adj)*]
well water (n; adj)*
white water (n)[W11]
white-water(adj)[W11]

*x*wide [22]
widespread (adj)[W11]
wide-spreading (adj)[W11]
willingness to pay (n)*
willingness-to-pay (adj)*
winter-kill (v)[W11]
winterkill (n)[W11]
worksheet (n+; adj*)

X-radiation (n)[W11]
X-ray (n; adj; v)[W11]
X-ray radiography (n)* [*not* X radiography]
x-section (n)[W11] [cross-section preferred]

x-year or *x* year [19,20]
year-class (n)+ [14]
year-class (adj)*
x-year-old(s) (n; adj)* [7]
yield per recruit (noun phrase)
yield-per-recruit model (noun phrase as adj)
young of year *or* young of the year (n; adj) [abbreviate as age-0; avoid YOY]
zoea (n)[W11] [plural: zoeae *or* zoeas]
zoeal (adj)[W3]

Notes

In the following notes the term "open" refers to a compound word in which the components are separated by spaces (e.g., "point source") and the term "closed" to a compound word in which the components are not separated by spaces (e.g., "warmwater").

(1) decision maker, *x* maker: Most compounds involving "maker" are open, but "policymaker" is an important exception.

(2) decision making; *x*-ing: Temporary compounds formed from a noun and a gerund are generally open as nouns, but many permanent compounds are closed (e.g., bookkeeping). Adjectival compounds formed from a noun and a present participle are hyphenated before the nouns they modify (e.g., decision-making event), and a few permanent compounds are hyphenated after the noun as well (e.g., thought-provoking).

(3) early: When used as an adjective, "early" can be hyphenated (e.g., early-life behavior). However, it may be better to rewrite some phrases (e.g., to use the adverbial form "early migrating salmon" instead of the adjectival form "early-migrant salmon"). Phrases such as "early life history" are not hyphenated because combinations like "life history" and "life stage" are treated as compound nouns (i.e., "early" modifies "life history").

(4) generating plant, generating station: These terms are open compound nouns, so modifiers preceding "generating" are not followed by hyphens (e.g., power generating station, electricity generating plant). (Note: A nuclear plant is not always a nuclear power generating plant [e.g., the Savannah River site produces nuclear material for defense rather than electricity]).

(5) fin fold, lateral line: Names of body parts should be treated as open compound nouns and not hyphenated when used as adjectives.

(6) mid, middepth, etc.: The word "mid" can be treated as an adjective, but AFS generally prefers to treat it as a prefix (e.g., midseason, midyear). It is hyphenated when it modifies a proper noun, date, or number (e.g., mid-August, mid-1988). If it is separated from its stem by other words, it can stand alone (e.g., mid to late March *but* early to mid-March).

(7) *x*-year-olds: There is some inconsistency in Webster's dictionaries with respect to these terms. AFS uses the hyphenated form for the noun as well as the adjective.

(8) cold brand, freeze brand: Although many compound nouns with the word "freeze" are hyphenated in Webster's dictionaries, nearly all compound nouns with the word "cold" are open; AFS has therefore chosen to leave all such terms open. Most compound nouns with the word "freezing" are open (e.g., freezing point), but most of the adjectival forms have hyphens (e.g., freezing-point measurement).

(9) mass mark, etc: Webster's dictionaries leave most compounds with "mass" open when they are nouns but hyphenate the adjectival and verb forms.

(10) purse-seine: The verb form is hyphenated for reasons of clarity, even though most of the verbs pertaining to capture techniques are closed (e.g., gillnet).

(11) B cell, R plasmid, T cell: All cytological entities designated by a capital letter should be left open as nouns and adjectives (e.g., T cell deficiency, B leukocyte measurements) unless treated otherwise in W11 or hyphens are needed because of the construction (e.g., T-cell-dependent antigens).

(12) radio tag, etc.: Webster's dictionaries close up all "radio" prefixes when they refer to radioactivity. When the reference is to the radio frequency spectrum, most such terms are open as nouns.

(13) non-yolk-bearing, pre-yolk-sac: When a prefix is added to a hyphenated word, a hyphen should come after the prefix.

(14) year-class: W3 lists "year class" as a noun, the only instance of an open "-class" or "-group" term. For editorial consistency, AFS hyphenates this term as a noun.

(15) carbon-14, cobalt-60, uranium-235: Although these isotopes are open in W11, the standard practice in scientific writing is to place a hyphen between the spelled-out element name and the mass number. When the element symbol is used, the number should be a superscript placed before the symbol (e.g., ^{32}P).

(16) first-order, second-growth: All rank-order compound adjectives are hyphenated.

(17) age-group, size-group, length-cohort; type *x*, *x*-type: Do not hyphenate adjectives of the forms "type *x*" and "group *x*" unless hyphenation is needed for clarity. Hyphenate all compound nouns and adjectives that end in "cohort," "group," or "type."

(18) *x* boat, *x*boat: Many boat types are open (e.g., charter boat, drift boat); others are closed (e.g., headboat, johnboat, motorboat, and speedboat). Open compounds can either be left open or hyphenated when used as adjectives.

(19) angler-day, angler-hour, net-day; *x*-day, *x*-hour, *x*-kilometer, *x*-mile: Use a hyphen in these rate or effort terms and in specialized units of measure such as light-year (distance) and acre-foot (volume).

(20) brood year, water year, etc.: These noun–noun combinations are measures of time (although they may be different from the calendar year); they are not efforts or rates (e.g., angler-hour) or units of measure (e.g., light-year), and like "fiscal year," they are left open as nouns and adjectives.

(21) bleb-like, virus-like; *x*like: Words formed with the suffix "like" are generally closed. However, "bleb-like" and "virus-like" are hyphenated for clarity and to follow common usage in the fish health literature.

(22) ecosystem-wide; *x*wide: Words with the suffix "wide" are generally closed; however, CMS allows them to be hyphenated if the root word is long or of several (more than two) syllables (thus "ecosystem-wide" but "systemwide").

(23) compact disc, disc brakes, etc.: There is considerable variation in W11 in the use of "disk" versus "disc," the former appearing to be the preferred spelling for most noncomputer terms except "disc brakes." Use "disk" for electronic storage media and "disc" for optical and video storage media, and follow the dictionary for other words.

(24) air bladder, gas bladder, swim bladder: These open compounds refer to the hydrostatic organ present in most fish. "Air bladder" and "gas bladder" are preferable to "swim bladder." "Air sac" should be reserved for the air-filled space in birds.

(25) length frequency, weight frequency: In keeping with the move toward not hyphenating noun–noun combinations used as adjectives, AFS no longer enforces its previous standard of hyphenating *x*-frequency words when they are used as adjectives. Hyphenated forms are acceptable, however.

Appendix B. *Abbreviations and Acronyms*

The following abbreviations and acronyms are encountered frequently in AFS publications. Unless indicated otherwise, they should be spelled out in full at first use.

AAAS	American Association for the Advancement of Science
Ab	antibody
ACE	Army Corps of Engineers
ACR	acute-chronic ratio
ACS	American Chemical Society (Washington, D.C.)
ACSIRO	Australia Commonwealth Scientific and Industrial Research Organisation
ADCP	Aquaculture Development and Coordination Programme (FAO)
ADF&G	Alaska Department of Fish and Game (ADFG also acceptable)
AEC	Atomic Energy Commission (became ERDA in 1977)
AFA	(1) Anadromous Fish Act; (2) a fixative consisting of acetic acid, formalin, and alcohol
AFCA	Anadromous Fish Conservation Act (see Fisheries 12[6]:7–9)
AFTA	American Factory Trawlers Association (Seattle)
AGU	American Geophysical Union
AI	artificial intelligence
AIBS	American Institute of Biological Sciences
AICHE	American Institute of Chemical Engineers
AID	Agency for International Development (U.S.)
AIFRB	American Institute of Fishery Research Biologists
ALS	American Littoral Society
A&M	e.g., Texas A&M University (*not* "A and M")
ANC	acid-neutralizing capacity
ANCOVA	analysis (*or* analyses) of covariance
ANL	Argonne National Laboratory (Argonne, Illinois)
ANODEV	analysis (*or* analyses) of deviance
ANOVA	analysis (*or* analyses) of variance
AOAC	Association of Official Analytical Chemists (Arlington, Virginia)
AOSERP	Alberta Oil Sands Environmental Research Program
APHA	American Public Health Association (Washington, D.C.)
APHIS	Animal and Plant Health Inspection Service (USDA)
API	(1) American Petroleum Institute; (2) Analytical Profile Index System (as in "API20E test strips"; standard notation, *no need to spell out*)
APL	(1) A Programming Language (*never spelled out* but should be identified as a computer language); (2) Applied Physics Laboratory (Laurel, Maryland)
ARC	Aquaculture Research Center (Norwegian; as in "Nutreco ARC")
ARMA	autoregressive moving average
ARS	Agricultural Research Service (USDA)
A/S	Aksje Selskap (Norwegian equivalent of "Inc."; *do not spell out*)
ASB	Association of Southeastern Biologists
ASCE	(1) American Society of Civil Engineers; (2) American Society of Chemical Engineers
ASCII	American Standard Code for Information Interchange (in Webster's, *no need to spell out*)
ASI	American Sportfishing Institute
asl	above sea level
ASME	American Society of Mechanical Engineers

ASMFC	Atlantic States Marine Fisheries Commission (Washington, D.C.)
ASPP	American Society of Plant Pathologists
ASTM	American Society for Testing and Materials (Philadelphia)
ASW	artificial seawater
ATCC	American Type Culture Collection (acronym used in the codes that designate cell lines)
ATP	adenosine triphosphate (in Webster's, *no need to define/spell out*)
AWG	American wire gage
b	base (usually used with a prefix to denote thousands of bases, i.e., kb; see bp)
BALB/c	strain of mouse (standard notation, *no need to spell out*)
BaP	benzo[*a*]pyrene
BARD	Binational Agricultural Research and Development
BASIC	Beginners All-Purpose Symbolic Instruction Code (in Webster's, *do not spell out*)
B.A.S.S.	Bass Anglers Sportsman Society
BB	brown bullhead (a cell line)
BBL	Baltimore Biological Laboratories
BCWD	bacterial cold-water disease
BHI	brain–heart infusion
BHIA	brain–heart infusion agar
BIA	Bureau of Indian Affairs (USDI)
BKD	bacterial kidney disease
BLM	Bureau of Land Management (USDI)
BMDP	Biomedical Programs (statistical software package published by the University of California Press)
BOD	biochemical oxygen demand
BOR	Bureau of Reclamation (USDI)
bp	base pair; a paired purine and pyrimidine in double-stranded DNA
BP	before present (radio carbon dating; present = 1950)
B.P.	Boite Postale (French equivalent of "Post Office Box")
BPA	Bonneville Power Administration (USDOE, Portland, Oregon)
BRD	Biological Resources Division (research arm of USGS)
BSA	bovine serum albumin
BSS	balanced salt solution (see HBSS)
BST	British summer time
BVET	basinwide visual estimation technique (see Dolloff et al., *NAJFM* 17[2])
CAD	computer-aided design
CAFIR	Comité d'Attribution des Fonds Internes de Recherche
CAFSAC	Canadian Atlantic Fisheries Scientific Advisory Committee (Dartmouth or Halifax, Nova Scotia)
CalCOFI	California Cooperative Oceanic Fisheries Investigations
CBE	Council of Biological Editors
CBG	C-bands treated with barium hydroxide and stained with Giemsa (e.g., "CBG-banded chromosomes")
CBI	Chesapeake Bay Institute (Baltimore)
CBL	Chesapeake Biological Laboratory
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCL	certified cell line (a designation of the American Type Culture Collection indicating a cell line that has been better studied and characterized than one designated CRL)
CCV	channel catfish virus cumulative
cdf	density function (see pdf)
CECPI	Commission Européenne Consultative pour les Pêches dans les Eaux Intérieures (FAO; see also EIFAC)
Cedex	Courrier d'Entreprise à Distibution Exceptionelle (basically a P.O. Box for businesses; *do not spell out*)

CEMAGREF	Centre d'Etude du Machinisme Agricole, du Rural, des Eaux et Forêts (Bordeaux, France)
CEMF	counter electromotive force (a voltage)
CEQ	Council on Environmental Quality (U.S.)
CERF	Coastal Education and Research Foundation (Charlottesville, Virginia)
CFA	complete Freund's adjuvant
CFI	Council of Forest Industries (Vancouver, Canada)
CFU	colony-forming unit (see PFU)
CGPM	Conseil Général des Pêches pour la Méditerranée (FAO; see also GFCM)
CHH	chum salmon heart (a cell line)
CHSE	Chinook salmon embryo (a cell line)
CI	confidence interval
CICESE	Centro de Investigación Científica y de Educación Superior de Ensenada (Baja California)
CICTUS	Center of Scientific and Technological Research of the University of Sonora
CIE	counterimmunoelectrophoresis
CIEM	Conseil International pour l'Exploration de la Mer (Charlottenlund, Denmark; see also ICES)
CIFA	Committee for Inland Fisheries of Africa (a committee in the Fisheries Division of FAO; also CPCA)
CIMAS	Cooperative Institute for Marine and Atmospheric Studies (Rosenstiel School of Marine and Atmospheric Sciences, University of Miami)
CISTI	Canada Institute for Scientific and Technical Information
CITES	Convention on International Trade in Endangered Species (of Wild Fauna and Flora)
CJFAS	Canadian Journal of Fisheries and Aquatic Sciences
CL	(1) certified line (a variant of CCL); (2) confidence limit
CMFRI	Central Marine Fisheries Research Institute (Ernakulum, Cochin, India)
CMOS	complementary-metal-oxide semiconductor
CNEXO	Centre National pour l'Exploitation des Océans (Paris; see IFREMER)
CNRS	Centre National de la Recherche Scientifique
COD	chemical oxygen demand
COE	Corps of Engineers (U.S. Army)
COLS	corrected ordinary least squares
COPESCAL	Comisión de Pesca Continental para América Latina (FAO)
COPRAQ	Cooperative Programme of Research in Aquaculture
CORR	correlation procedure (SAS statistical procedure)
C.P.	(1) Casier postal (French for "postal drawer"; *do not spell out*) (2) Código postal (Spanish for "postal code"; *do not spell out*)
CPCA	Comité des Pêches Continentales pour l'Afrique (FAO; also CIFA)
CPE	(1) catch per effort (can also stand for "catch per unit [of] effort"); (2) cytopathic effect
CPUE	catch per unit (of) effort
CR	Carrier Route (in address)
CRD	Coastal Resource Division (NMFS)
CREES	Cooperative Research, Education, and Extension Service (USDA; see CSREES)
CRL	cell repository line (designation of the American Type Culture Collection; see CCL)
cRNA	complementary RNA
CRSP	Cooperative Research Support Program (Pond Dynamics Aquaculture)
CSE	coho salmon embryo (a cell line)
CSIC	Consejo Superior de Investigaciones Científicas
CSIR	Council of Scientific and Industrial Research (New Delhi, India)
CSIRO	Commonwealth Scientific and Industrial Research Organization (often preceded by the first letter of a country; see ACSIRO)
CSREES	Cooperative State Research, Education, and Extension Service (USDA)
CSRS	Cooperative State Research Service (under Science and Education in USDA)
CT	buffer system of Clayton and Tretiah (1972)
CTAB	hexadecyltrimethylammonium bromide (used in the process of extracting mtDNA; entered as centrimonium bromide in Merck, but accept the more common alternative name)

CTM	critical thermal maximum (does not require further definition in Abstract but needs explanation in Methods; see UILT)
CV	coefficient of variation (must be defined; usually 100 × SD/mean but sometimes 100 × SE/mean)
Da	dalton (unit of molecular mass; often kDa [1 Da = 1 g/Avogadro's number]; note: no units if molecular *weight*)
DAPI	4',6-diamidino-2-phenylindole (a stain)
DBA	dot blot analysis (*or* assay)
DDBA	direct dot blot assay
DDE	1,1-dichloro-2,2-bis(*p*-chlorophenyl)ethane (in Webster's, *no need to spell out*); also known as DDD (dichlorodiphenyldichloroethane, which is in Webster's), *p*,*p*'-DDD, and TDE (tetrachlorodiphenylethane)
DEA	Department of External Affairs (Canada)
DEAE	diethylaminoethanol (often used in descriptions of column chromatography; e.g., "DEAE–cellulose")
DEC	Department of Environmental Conservation (an agency of several states, e.g., "NYDEC")
DEMR	Department of Energy, Mines, and Resources (Canada)
Dep.	(definition unknown; essential part of some Norwegian addresses)
DFO	Department of Fisheries and Oceans (Canada)
DGICYT	Dirección General de Investigación Científica y Téchnica (Spain)
DIC	disseminated intravascular coagulation
DIG	digoxigenin
DMSO	dimethyl sulfoxide (in Webster's, *no need to spell out*)
DNase	sometimes DNAase: deoxynuclease (in Webster's, *no need to spell out*)
dNTP	deoxynucleotide triphosphate
DO	dissolved oxygen
DOC	(1) Department of Commerce (U.S.); (2) Department of Conservation (an agency of several states)
DOE	Department of Energy (U.S.)
DORM	dogfish reference material (for trace elements)
DPD	diethylphenylenediamine
DPST	double-pole single-throw switch
DSARMA	deseasonalized ARMA
EC	(1) emulsifiable concentrate; (2) European Commission
ECP	extracellular product(s)
EDF	European Development Fund
EDTA	ethylenediaminetetraacetic acid (in Webster's, *no need to spell out*)
E_i	Ivlev's electivity index
EIBS	erythrocytic inclusion body syndrome
EIFAC	European Inland Fishery Advisory Commission (FAO; see also CECPI)
EIS	environmental impact statement
ELIFA	enzyme-linked immunofiltration assay
ELISA	enzyme-linked immunosorbent assay
EMAP	Environmental Monitoring and Assessment Program (EPA)
EMEM	Eagle's minimum essential medium
EMF	electromotive force
EMI	electromagnetic interference
EMSL	Environmental Monitoring Systems Laboratory (EPA)
EN–SO	El Niño–Southern Oscillation
ENV	erythrocytic necrosis virus
EPA	Environmental Protection Agency (U.S. and some state governments; acceptable with full identification)

EPC	epithelioma papillosum cyprini (cell line derived from an epithelial tumor of common carp)
EPRI	Electric Power Research Institute (Palo Alto, California)
EPSCoR	Experimental Program to Stimulate Competitive Research (NSF)
ERDA	Energy Research and Development Administration (DOE)
ERM	enteric redmouth (disease)
EROD	7-ethoxyresorufin-*O*-deethylase
ESU	evolutionarily significant unit
F	filial generation (on AFS symbols list; *does not need definition*)
F	instantaneous fishing mortality
$F_{0.1}$	(a) fishing mortality at which yield per recruit is 10% less than its value at F_{MAX}; (b) fishing mortality at which the slope of the yield-per-recruit curve is 10% of the value at zero fishing mortality; (c) fishing mortality at which the marginal increase in yield from adding one more unit of fishing effort is 10% of the increase in yield from adding the same unit of effort in the very lightly exploited fishery; (d) fishing mortality at which the marginal increase in total yield is one-tenth the original catch per unit effort (all of these definitions are equivalent)
F_{MAX}	(a) fishing mortality at which the yield-per-recruit curve has its maximum; or equivalently (b) fishing mortality below which growth overfishing is prevented
FAA	formol–acetic acid–alcohol
Fab	fragment, antigen-binding arm (the region or fragment [either of two] of an IgG molecule that contains the antigen-combining site
$F(ab)_2$	fragment of an IgG molecule that contains both Fab regions and the hinge region connecting them
FAME	fatty acid methyl ester
FAO	Food and Agriculture Organization of the United Nations (Rome)
FASEB	Federation of American Societies for Experimental Biology (Bethesda, Maryland)
FAT	fluorescent antibody technique (also see MF-FAT)
FCA	Freund's complete adjuvant (see FIA)
FCAR	Fonds pour la Formation de Chercheurs de l'Aide à la Recherche
FCMA	Fishery Conservation and Management Act (Public Law 94-265 of 1976; see MFCMA)
FDA	Food and Drug Administration (U.S.)
FDP	fibrin degradation products
FEBS	Federation of European Biochemical Societies
FEMAT	Forest Ecosystem Management Assessment Team (representatives of USFS, BLM, USFWS, NPS, EPA, and NMFS; studies problems of Pacific Northwest forests)
FERC	Federal Energy Regulation Commission (DOE)
FERIC	Forest Engineering Research Institute of Canada
FET	field-effect transistors
FFA	filtration–fluorescent antibody (a staining method)
FFI	Fish Farming International
FHM	fathead minnow (a cell line)
FIA	Freund's incomplete adjuvant
FITC	fluorescein isothiocyanate
FL	fork length (fish length from snout to the cleft of a forked caudal fin)
FMC	Fishery Management Council
FONDE PESCA	Fondo Nacional para el Desarrollo de la Pesca (Mexico)
FORTRAN	*for*mula *tran*slation (*or* Fortran; in Webster's, *no need to spell out*)
FRBC	Fisheries Research Board of Canada
FRED	Fisheries Rehabilitation, Enhancement, and Development (ADF&G)
FSH	follicle-stimulating hormone
FTU	formazin turbidity unit

g	gravity or acceleration due to gravity (e.g., "5,000 × *g*"; spelled out unless used more than once)
G_0	cell-cycle phase consisting of the period of quiescence after cell division
G_1	cell-cycle phase consisting of the "preparatory" period before DNA synthesis
G_2	cell-cycle phase consisting of the period after DNA synthesis and before cell division
G_i	inhibiting form of trimenic G proteins (as used in *JAAH* 8:10)
GENBANK	a genetics database of the National Center for Biotechnology Information at the National Library of Medicine, National Institutes of Health, Bethesda, Maryland (*no need to define in JAAH*)
GFCM	General Fisheries Council for the Mediterranean (FAO; see CGPM)
GFDL	Geophysical Fluid Dynamics Laboratory (Princeton University; acronym is applied to a general circulation climate model developed at the laboratory)
GH	growth hormone
GIS	geographical information systems
GISS	Goddard Institute for Space Sciences (acronym is applied to a general circulation climate model developed at NASA Goddard Space Flight Center, Greenbelt, Maryland)
GLC	(1) gas–liquid chromatography; (2) Great Lakes Commission (Ann Arbor, Michigan)
GLFC	Great Lakes Fishery Commission (Ann Arbor, Michigan)
GLIM	general(ized) linear interactive model
GLM	general(ized) linear model (acronym of SAS Institute)
GLP	good laboratory practice
GLPS	good laboratory practice standards
GLRC	Great Lakes Research Consortium
GLS	generalized least squares
GmbH	German equivalent of "Co." or "Corp."
GMFMC	Gulf of Mexico Fishery Management Council (Tampa, Florida)
GnRH	gonadotropin-releasing hormone; synonym of LHRH
GPC	Government Printing Centre (Canada)
GPO	(1) Government Printing Office (Washington, D.C.); (2) General Post Office (in Australian addresses)
GPS	Global Positioning System
GRAS	generally recognized as safe (FDA registration standard)
GSI	gonadosomatic index (calculated by dividing the weight of reproductive tissue by the total body weight)
GSMFC	Gulf States Marine Fisheries Commission (Ocean Springs, Mississippi)
GtH	gonadotropic hormone
H&E	hematoxylin and eosin (a group of stains; equivalent to HE)
HAT	hypoxanthine, aminopterin, and thymidine (a tissue culture medium)
Hb	hemoglobin
HBSS	Hanks' balanced salt solution (= physiological saline)
HCG	human chorionic gonadotropin
HCP	health and condition profile (e.g., Goede and Barton in AFS Symposium 8)
HCR	Highway Contract Route (in addresses, e.g., "HCR-7, Box 27"; *do not spell out*)
Hct	hematocrit
HE	hematoxylin–eosin (a group of stains; equivalent to H&E)
HEPES	*N*-(2-hydroxyethyl)-1-piperazineethanesulfonic acid (a buffer; primary entry in the Merck Index, *no need to spell out*)
HPI axis	hypothalamic–pituitary–interrenal axis
HPLC	high-performance liquid chromatography
HRP	horseradish peroxidase
HSD	honestly significantly different (*also*, honestly significantly difference test)
HUFA	highly unsaturated fatty acid

IAEA	International Atomic Energy Agency (Vienna)
IAFWA	International Association of Fish and Wildlife Agencies
IAM	Institute of Applied Microbiology (University of Tokyo)
IATTC	Inter-American Tropical Tuna Commission (Scripps Institution of Oceanography, La Jolla, California)
IBI	index of biotic integrity
IBP	International Biological Programme
IC	integrated circuit
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea (see also CIEM)
ICLARM	International Center for Living Aquatic Resources Management (Manila, Philippines)
ICNAF	International Commission for the Northwest Atlantic Fisheries (now defunct; replaced by NAFO)
ICP	inductively coupled argon plasma emission spectrometry
ICPRB	Interstate Commission on the Potomac River Basin
ICU	international chick units (used with vitamin dosages)
ID	inside diameter
IDBA	indirect dot blot assay
IDRC	International Development Research Centre (Ottawa, Canada)
IEEE	Institute of Electrical and Electronics Engineers
IFAT	indirect fluorescent antibody test (or technique)
IFIM	instream flow incremental methodology
IFR	instream flow recommendation
IFRDC	Institut Français de Recherche Scientifique pour le Developpement en Cooperation
IFREMER	Institut Français de Recherche pour l'Exploitation de la Mer (Paris [also Nantes], France)
IFS	International Foundation for Science (Stockholm, Sweden)
IgA	immunoglobulin A (other immunoglubulins: IgD, IgE, IgG, and IgM)
IGFA	International Game Fish Association
IHHNV	infectious hypodermal and hematopoietic necrosis virus (*or* IHHN virus)
IHNV	infectious hematopoietic necrosis virus (or IHN virus)
IJC	International Joint Commission (Washington, D.C.)
ILT	incipient lethal temperature
*I*n	informativeness index
INAD	investigational new animal drug (a type of FDA permit)
INPFC	International North Pacific Fisheries Commission (Vancouver, British Columbia)
INRA	Institut National de la Recherche Agronomique (several locations in France and its former colonies)
INRAT	(*or* I.N.R.A.T.) Institut National de la Recherche Agronomique Tunisia (Arabia)
I–O	input–output (a type of economic analysis)
IOC	Intergovernmental Oceanographic Commission
ip	intraperitoneal(ly) (sometimes IP or i.p.)
IPFC	Indo-Pacific Fisheries Commission (FAO)
IPHC	International Pacific Halibut Commission (Seattle)
IPNV	infectious pancreatic necrosis virus (*or* IPN virus)
IPSFC	International Pacific Salmon Fisheries Commission
IPTP	Indo-Pacific Tuna Development and Management Programme
IRI	index of relative importance
ISACF	International Society of Arctic Char Fanatics (published in Drottningholm, Sweden)
ISH	in situ hybridization
ISO	International Organization for Standardization (Geneva, Switzerland)
IWC	International Whaling Commission (Cambridge, UK)
JEM	a company name (now JEOL, Ltd., Peabody, Massachusetts)
JFRBC	Journal of the Fisheries Research Board of Canada (became CJFAS in 1980)
JTU	Jackson turbidity units

K	condition factor (generally $10^5 \times$ weight/fork length^3)
K/A	alkaline/acid
kDa	kilodaltons
KDM	kidney disease medium
K1K	walking catfish kidney (a cell line)
LC50	concentration that is lethal to 50% of test organisms in a specified time (usually 96 h; different mortality criteria and time periods are possible)
LD50	dose that is lethal to 50% of test organisms in a specified time
LED	light-emitting diode
LGLFRO	Lower Great Lakes Fisheries Resources Office (USFWS)
LH	luteinizing hormone
LHRF	luteinizing hormone releasing factor (an acceptable synonym for LHRH)
LHRH	luteinizing hormone releasing hormone
LHRH-A	synthetic analogues of LHRH
LILT	lower incipient lethal temperature
LOEC	lowest-observed-effect concentration (see NOEC)
LPS	lipopolysaccharide
LSC	liquid scintillation count (counting)
LSD	least significant difference (*also*, least-significant-difference test)
LT50	temperature that is lethal to 50% of test organisms (invariably refers to the upper temperature limit)
LWD	large woody debris (or lwd)
M	instantaneous natural mortality
M	cell-cycle phase consisting of the period of cell division
MAb	(*or* MoAb) monoclonal antibody
MAFF	Ministry of Agriculture, Fisheries, and Food (Great Britain)
MAFMC	Mid-Atlantic Fishery Management Council (Washington, D.C.)
MANOVA	multivariate ANOVA
MARFIN	Marine Fisheries Initiative Program (USDOC)
MARMAP	Marine Resources Monitoring, Assessment, and Prediction (a program of NMFS)
MATC	maximum acceptable toxicant concentration
MDS	a manufacturer's designation (*do not spell out*)
m/e	ratio of molecular mass (weight) to ionic charge (used in mass spectrometry; also denoted *m/z*)
MEH	mean erythrocytic hemoglobin
MEHC	mean erythrocytic hemoglobin content
MEI	morphoedaphic index
MEM	minimum essential medium
meq	milliequivalents (blood Na and K are often given as meq/L)
MEV	(1) mean erythocyte volume; (2) million electron-volts
MFCMA	Magnuson Fishery Conservation and Management Act (see FCMA)
MF–FAT	membrane filtration–fluorescent antibody technique
mho	unit of conductance or conductivity (replaced by S [siemens] in the International System of Units)
MIC	minimum inhibitory concentration of a drug (e.g., MIC50 is the minimum concentration needed to inhibit the growth of cultured bacteria or other cells by 50%)
MICRA	Mississippi Interstate Cooperative Resource Association (Bettendorf, Iowa)
micron	micrometer (in Webster's, but not allowed in AFS style; *spell out or use* μm)
mil	nonmetric measure of thickness (1 mil = 0.001 in = 0.0254 mm; *not an abbreviation*)
MMC	Marine Mammal Commission (Washington, D.C.)
MNRM	(*or* M.N.R.M.) Master's of Natural Resource Management (use "master's thesis" in AFS references)
MOA	memorandum of agreement

MoAb	(*or* MAb) monoclonal antibody
mos	metallic-oxide semiconductor
MOSFET	metallic-oxide semiconductor field-effect transistor
MOU	memorandum of understanding
mRNA	messenger RNA
MS	mean square
MS-222	tricaine methanesulfonate (proprietary name)
MSE	mean square(d) error (*not* "mean SE" or "mean^2 error")
MSH	melanocyte-stimulating hormone (occurs in two forms: alpha- and beta-MSH)
msl	mean sea level
MSY	maximum sustainable yield
mtDNA	mitochondrial DNA
m/z	see *m/e*

N	normal (chemical term)
NAD	nicotinamide adenine dinucleotide (in Webster's, *no need to spell out*)
NADH	reduced form of NAD (in Webster's, *no need to spell out*)
NADP	(1) nicotinamide adenine dinucleotide phosphate (in Webster's, *no need to spell out*); (2) National Atmospheric Deposition Program
NADPH	reduced form of NADP (in Webster's, *no need to spell out*)
NAFO	North Atlantic Fisheries Organization (supercedes ICNAF; Dartmouth, Nova Scotia)
NAPAP	National Acid Precipitation Assessment Program
NASCO	North Atlantic Salmon Conservation Organization
NAS–NAE	Academy of Sciences–National Academy of Engineering
NBII	national biological information infrastructure
NBT	nitro-blue tetrazolium
NCASI	National Council of the Paper Industry for Air and Stream Improvements (New York)
NCMB	National Collection of Marine Bacteria
NCRAC	North Central Regional Aquaculture Center
NCSS	a computer package
NCTC	National Collection of Type Cultures (now NTCC)
NEAFC	North-East Atlantic Fisheries Commission (London)
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center Natural
NERC	Environmental Research Council (UK)
NF	nombre fondamental (chromosome arm number)
NFE	nitrogen-free extract
NFFR	Norwegian Council of Fisheries Research
NGVD	National Geodetic Vertical Datum (see Kondolf, *TAFS* 125[6])
NIEHS	National Institutes of Environmental Health Services
NIFI	(*or* N.I.F.I.) National Inland Fisheries Institute (Fisheries Department, Bangkok, Thailand)
NIH	National Institutes of Health
NINA	Norwegian Institute for Nature Research
NMFS	National Marine Fisheries Service (NOAA)
NOAA	National Oceanic and Atmospheric Administration (USDOC)
NOEC	no-observed-effect concentration (see LOEC)
NOS	National Ocean Service (USDOC)
NPS	National Park Service (USDI)
NRC	(1) National Research Council (U.S.); (2) Nuclear Regulatory Commission (U.S.)
NRCC	National Research Council of Canada
NRCS	Natural Resources Conservation Service (USDA; formerly SCS)
NRI	National Research Initiative (USDA)
NRICGP	National Research Initiative Competitive Grants Program (USDA)

nRNA	nuclear RNA
NSERC	Natural Sciences and Engineering Research Council of Canada
NSF	National Science Foundation (U.S.)
NTCC	National Type Culture Collection (Rockville, Maryland)
NTIS	National Technical Information Service (Springfield, Virginia)
NTNF	Norwegian Council for Scientific and Industrial Research
NTU	nephelometric turbidity units
NWRI	National Water Research Institute
OCS	outer continental shelf
OD	(1) optical density; (2) outside diameter
OECD	Organisation for Economic Cooperation and Development (Paris)
OIE	Office International des Epizooties (Paris)
OLS	ordinary least squares
OMNR	Ontario Ministry of Natural Resources
OMP	Oregon Moist Pellet (a feed; capitalized)
OPD	*o*-phenylenediamine (a substrate solution for ELISA)
ORNL	Oak Ridge National Laboratory
ORSTOM	(*or* O.R.S.T.O.M.) Office de la Recherche Scientifique et Technique Outre-Mer
OSY	optimum sustainable yield
OTC	oxytetracycline
P-4501A	cytochrome P-4501A (an enzyme used to monitor exposure to petroleum products)
p.a.	pro analysis (a grade of chemicals, as in p.a. grade; standard notation; *no need to spell out*)
PAGE	polyacrylamide gel electrophoresis (see SDS)
PAH	polycylic aromatic hydrocarbon
PAR	periodic autoregressive
PAS	periodic acid–Schiff (a stain)
PAUP	phylogenetic analysis using parsimony
PBS	phosphate-buffered saline
PC	polycarbonate
PCA	principal components analysis
P_{CO2}	(*or* pCO_2) partial pressure of the gas CO_2 (PCO_2 preferred but pCO_2 acceptable)
PCR	polymerase chain reaction
PDB	Pee Dee belemnite (isotopic standard for $^{13}C/^{12}C$ ratio)
pdf	probability density function (*not* probability distribution function; see cdf)
PEG	polyethylene glycol
PERCIS	Percid International Symposium (published in JFRBC 34[10])
PFA	perfluoroalkoxy (as in Teflon PFA pipe)
PFMC	Pacific Fishery Management Council
PFU	plaque-forming unit (see cfu)
PGD	(*or* PKX) proliferative gill disease
PHA	phytohemagglutinin (erythrocyte agglutinator and T cell mitogen)
PHABSIM	physical habitat simulation system (*no need to spell out*)
Pi	inorganic phosphate
pI	isoelectric point of a protein (i.e., the pH at which its net charge is 0)
PIPES	piperazine-*N*,*N*-bis-[2-ethanesulfonic acid]
PKX	see PGD
PIT	passive integrated transponder (may be used in title if defined in Abstract)
PMSF	phenylmethylsulponyl-fluoride
PNFHPC	Pacific Northwest Fish Health Protection Committee
P_{O2}	(*or* pO_2) partial pressure of oxygen gas (PO_2 preferred but pO_2 acceptable)

PONAR	dredge used to sample sediments, especially in the Great Lakes region (does not need definition, but should be all caps; letters stand for the surnames of the inventors)
POW	programmable output waveform (e.g., "POW backpack electroshocker [Smith-Root]")
ppm	parts per million (not allowed in *TAFS* or *JAAH*; *change to metric*)
pro	as in "pro analysis" (see p.a.)
PSC	Pacific Salmon Commission (Vancouver, British Columbia)
PSD	proportional stock density
PSMFC	Pacific States Marine Fisheries Commission (Portland, Oregon)
PUD	Public Utility District (unique to the State of Washington)
PUFA	polyunsaturated fatty acid
PVC	polyvinyl chloride
PVP	polyvinyl pyrrolidone
Q	discharge or flow of water; a subscript sometimes denotes the frequency of a particular discharge (e.g., Q_{50} denotes a 50-year flood, $Q_{2.33}$ a discharge that occurs every 2.33 years on the average)
Q_{10}	factor by which a physiological rate increases for a 10°C rise in temperature
RAPD	randomly amplified polymorphic DNA
RBC	(*or* rbc) red blood cell
REAP	Restriction Enzyme Analysis Package (a computer program)
RFLP	restriction fragment length polymorphism
RFMC	Regional Fishery Management Council
RIA	radioimmunoassay
RKM	(*or* rkm) river kilometer (usually refers to distance above the river's mouth, but zero point should be defined)
RM	river mile (see RKM)
rms	root mean square
RNase	(*or* RNAase) ribonuclease (in Webster's, *no need to spell out*)
RNRF	Renewable Natural Resources Foundation (Bethesda, Maryland)
RPMI	a type of complete medium (sometimes followed by a hyphen and number; e.g., "RPMI-1640"; stands for Rosswell Park Memorial Institute but is *never spelled out*)
RRET	representative reach extrapolation technique (see Dollof et al., *NAJFM* 17[2])
rRNA	ribosomal RNA
RSD	relative stock density
RSL	buffer system of Ridgeway et al. 1970 (see reference in Kriegler et al., *NAJFM* 15[4])
RSMAS	Rosenstiel School of Marine and Atmospheric Science (University of Miami)
RTH	rainbow trout hepatoma (a cell line)
RTLA	Registry of Tumors in Lower Animals
S	(1) cell-cycle phase consisting of the period of DNA synthesis; (2) Svedberg unit (used to denote sizes of RNA molecules, e.g., a 1S molecule has a sedimentation coefficient of 1×10^{-13} s and an 18S molecule has a coefficient of 18×10^{-13} s)
SAF	Society of American Foresters (Bethesda, Maryland)
SAFMC	South Atlantic Fishery Management Council (Charleston, South Carolina)
SAS	Statistical Analysis System (created by the SAS Institute, Cary, North Carolina)
SCOL	Salmonid Communities in Oligotrophic Lakes (symposium published in JFRBC 29[6])
SCOPE	Scientific Committee on Problems of the Environment
SCS	Soil Conservation Service (USDA; now called NRCS)
SCSP	South China Sea Fisheries Development Coordinating Programme (FAO)
SD	standard deviation
SDA	specific dynamic action (the metabolic heat loss from the digestion and transformation of food,

	measured in J/[kg × h])
SDI	shoreline development index (ratio of shoreline length to the circumference of a circle with the same area as the water body)
SDS	sodium dodecyl sulfate (used in conjunction with polyacrylamide gel electrophoresis; sometimes denoted SDS–PAGE)
SE	standard error
SEAFDEC	Southeast Asian Fisheries Development Center (Bangkok, Thailand)
SEM	scanning electron microscope (*or* microscopy)
SETAC	Society of Environmental Toxicology and Chemistry
SFI	Sport Fishing Institute (Washington, D.C.; now part of ASI)
SFIA	Sea Fish Industry Authority (Hull, UK)
SGR	specific growth rate
SH	sulfhydryl
SIAM	Society for Industrial and Applied Mathematics (Philadelphia)
SIC	standard industrial classification
SINE	short interspersed repetitive DNA element (e.g., "*Hpa* I SINE")
S–K	Saltonstall–Kennedy (NMFS program that provides grants for marine research)
SL	standard length (fish length measured from snout to insertion of caudal fin rays on the last vertebra)
SNARL	Sierra Nevada Aquatic Research Laboratory (Mammoth Lakes, California)
SOPHEIA	solid-phase enzyme immunoassay, trademarked as a kit
sp.	species (plural: spp.; *no need to spell out*)
SP-4	agar (standard notation, *no need to spell out*)
SPC	South Pacific Commission (Noumea, New Caledonia)
SPF	specific pathogen free
SPOF	Strategic Plan for Ontario Fisheries
spp.	species (plural of sp.)
SPSS	Statistical Package for the Social Sciences (McGraw-Hill)
SPST	single-pole single-throw (a kind of switch)
SRBC	sheep red blood cells
SRR	stock–recruit(ment) relationship
SS	sum of squares
SSC	standard sodium citrate (a solution of 150 mM NaCl and 15 mM sodium citrate that is often used to stabilize preparations for DNA analysis [the actual concentration of the solution is usually expressed as a multiple of the standard: 5× SSC, 0.1× SSC, etc.])
SSE	sockeye salmon embryo (a cell line)
ssp.	subspecies
SSP	Society for Scholarly Publishing
SST	sea surface temperature
STE	salt–tris–EDTA (a buffer)
SV	simian virus
	triiodothyronine (a thyroid hormone)
T_3	thyroxine (a thyroid hormone)
T_4	Tween-20
T20	total allowable catch
TAC	tris-acetate–EDTA (a buffer)
TAE	total ammonia nitrogen
TAN	Technical Association of the Pulp and Paper Industry (Norcross, Georgia)
TAPPI	thiobarbituric
TBAR	tris–boric acid (borate)–EDTA (a buffer)
TBE	thiosulphate–citrate–bile–sucrose
TCBS	tissue culture infective dose of a cytopathogenic agent (virus) that produces a cytopathic effect in 50% of inoculated cultures (in *JAAH*, often "tissue culture infectious dose with 50% endpoint")
TCID50	

TDE	tetrachlorodiphenylethane (see DDE)
TDS	total dissolved solids
TE	tris–EDTA (a buffer)
TED	turtle excluder device
TEM	transmission electron microscope (*or* microscopy)
TFN	transfer-function noise (a model)
TINRO	Pacific Scientific Research Institute of Fisheries and Oceanography (Russia)
TL	total length (fish length measured from snout to tip of longest caudal fin ray)
TLC	thin-layer chromatography
TRLSC	time-resolved liquid scintillation count (counting)
tRNA	transfer RNA
TSB	trypticase soy broth *or* tryptic soy broth (*not* "soya")
TSP	(*or* tsp) triple super phosphate
TTBS	tris–Tween buffered saline (a typical formulation: 50 mM tris, 0.9% NaCl, 0.1% Tween-20; final pH 7.2)
TVA	Tennessee Valley Authority
TVG	time-varied gain *or* time-varying gain (hydroacoustic term)
TYES	trypticase yeast extract agar + skim milk
U	unit (used chiefly for drugs or other pharmaceuticals)
UILT	upper incipient lethal temperature (see ctm)
UNDP	United Nations Development Programme (New York)
UNEP	United Nations Environment Programme (Nairobi, Kenya)
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UPGMA	unweighted pair-group method with arithmetic averages
USACE	U.S. Army Corps of Engineers
USAID	U.S. Agency for International Development
USBLM	U.S. Bureau of Land Management
USDA	U.S. Department of Agriculture
USDA/NRI	U.S. Department of Agriculture, National Research Initiative
USDI	U.S. Department of the Interior
USDOC	U.S. Department of Commerce
USDOE	U.S. Department of Energy
USFS	U.S. Forest Service (USDA)
USFWS	U.S. Fish and Wildlife Service (USDI)
USGS	U.S. Geological Survey
USNM	U.S. National Museum
USP	U.S. Pharmacopeia *or* U.S. Pharmaceutical (grade; may need to add "units")
VCR	video cassette recorder (in Webster's, *no need to spell out*)
VEN	viral erythrocytic necrosis
VESO	Veterinaermedisink Senter for Oppdragvirksomhet (Norwegian for "veterinary contract research center"; *do not spell out*)
VHS	(1) viral hemorrhagic septicemia; (2) video home system
VHSV	viral hemorrhagic septicemia virus (also referred to as the Egtved virus)
VI	visual implant (type of tag)
VNIRO	a publishing company (Moscow)
VNTR	variable number of tandem repeats (refers to repeated sequences of DNA bases in a gene)
VOM	volt-ohm-milliammeter or voltohm milliammeter (a multimeter used to measure volts, ohms, and milliamperes)
VP	Voges–Proskauer test (APHA)
VPA	virtual population analysis

v/v	(*or* v:v) volume per volume (mL/L; only used parenthetically)
WAS	World Aquaculture Society
WRRI	Water Resources Research Institute
WSD	wholly significantly different (*or*, wholly significant difference test)
WTA	willingness to accept (compensation)
WTP	willingness to pay
w/v	(*or* w:v) weight per volume (g/L; only used parenthetically)
w/w	(*or* w:w) weight per weight (mg/g; only used parenthetically)
YOY	young of (the) year (*avoid using this acronym*; define young of [the] year as "age 0" and use that term thereafter)
Z	instantaneous total mortality (= natural + fishing mortality)

Appendix C. *Plurals of Fish Names*

The plurals of most fish names are formed by adding the letters *s* or *es* (with stem changes as appropriate) to the singular. In a few cases, however, the plural is the same as the singular or more than one plural is acceptable.

Names That Change in the Plural

C.1 Compound names with terminal roots that are common to more than one species usually change in the plural (exceptions are noted):

-back(s) *but* quillback
-blenny (-blennies)
-diver(s)
-eel(s)
-eye(s)

-fin(s)
-head(s) *but* flathead, steelhead
-horse(s)
-ing(s) *but* grayling, herring
-jack(s) *but* skipjack
-man (-men)
-mouth(s)
-rag(s)
-roller(s)
-side(s)

-snout(s)
-sucker(s)
-tail(s) *but* yellowtail
-wife (-wives)

C.2 The following names also change in the plural:

acara(s)
aegujon(s)
anchoveta(s)
argentine(s)
aulopus(es)

bairdiella(s)
balao(s)
ballyhoo(s)
barb(s)
barbier(s)

barbu(s)
barracudina(s)
basslet(s)
beaugregory (-ies)
beauty (-ies)

blacksmith(s)
blenny (-ies)
blindcat(s)
bloater(s)
bluegill(s)

bobo(s)
bocaccio(s)
boga(s)
brotula(s)
bumper(s)

cabezon(s)
cabrilla(s)
capelin(s)
catalufa(s)
chihuil(s)

chilipepper(s)
choice(s)
chromis(es)
cichlid(s)
cisco(es)

cobia(s)
cockscomb(s)
codlet(s)
coney(s)
conger(s)

corbina(s)
corvina(s)
cottonwick(s)
crappie(s)
croaker(s)

ctenopoma(s)
cubbyu(s)
cui-ui(s)
cunner(s)
dab(s)

daggertooth(s)
danio(s)
darter(s)
Dempsey(s)
dick(s)

diver(s)
doctor(s)
dolphin(s)
dory (-ies)
dragonet(s)

durgon(s)
eel(s)
finspot(s)
flag(s)
flier(s)

gag(s)
gambusia(s)
gaper(s)
gar(s)
garibaldi(s)

graysby (-ies)
grenadier(s)
grubby (-ies)
grunion(s)
grunt(s)

guaguanche(s)
gunnel(s)
guppy (-ies)
halfbeak(s)
halfmoon(s)

hamecon(s)
hamlet(s)
high-hat(s)
hitch(es)

hogchoker(s)
ide(s)
inconnu(s)
jack(s)
jambeau(s)

jenny (-ies)
jumprock(s)
kiyi(s)
lamprey(s)
lance(s)

leatherjacker(s)
livebearer(s)
liza(s)
lookdown(s)
lord(s)

louver(s)
machete(s)
madtom(s)
major(s)
mako(s)

manta(s)
margate(s)
marlin(s)
marlin-spike(s)
medaka(s)

miller(s)
mobula(s)
mojarra(s)
molly (-ies)
moray(s)

mouthbrooder(s)
mummichog(s)
opah(s)
oscar(s)
palometa(s)

permit(s)
pike-conger(s)
pilchard(s)
pirambeba(s)

poacher(s)
pomfret(s)
porbeagle(s)
puffer(s)
pumpkinseed(s)

raven(s)
ray(s)
remora(s)
rivulus(es)
roller(s)

ronquil(s)
rover(s)
rudd(s)
runner(s)
salema(s)

sanddab(s)
sargo(s)
sauger(s)
saury (-ies)
scamp(s)

schoolmaster(s)
seadevil(s)
searcher(s)
searobin(s)
seasnail(s)

sennet(s)
senorita(s)
sergeant(s)
shanny (-ies)
shark(s)

shiner(s)
shulupaoluk(s)
sierra(s)
siscowet(s)
sleeper(s)

smoothhound(s)
smoothtongues(s)
sole(s)
stargazer(s)

stingray(s)
stonecat(s)
sucker(s)
surgeon(s)
sweeper(s)

tang(s)
tattler(s)

tautog(s)
tetra(s)
thresher(s)
timucu(s)
tomtate(s)

torpedo(es)
trahira(s)

wahoo(s)
wakasagi(s)
warbonnet(s)
whiff(s)
windowpane(s)

wrasse(s)

Names for Which the Singular and Plural Are the Same

C.3 The plural is the same as the singular for the following names or terminal roots:

albacore
anchovy
barracuda
bass, -bass
bonito

bream
buffalo
burbot
carp
cero

char
chub
cod, -cod
cusk
dace

escolar
eulachon
fish, -fish
flathead
flounder

goby

gouramy
grayling
grouper
gurnard

haddock
hake
halibut
herring
hind

kawakawa
mackerel
menhaden
minnow, -minnow
mola

mullet
muskellunge
perch, -perch
pickerel
pike

plaice
pollack
pollock
pompano
porgy

pout, -pout

quillback
roach
saithe
salmon, -salmon

sardine
scad
scup
shad
skate

skipjack
smelt, -smelt
snapper
snook
splake

spot
squeteague
steelhead
tarpon
tench

tiger
trout, -trout
tuna
tunny
turbot

yellowtail

Names with More than One Plural

C.4 The following seven names have two acceptable plurals:

Dolly Varden	*or*	Dolly Vardens
drum	*or*	drums
kokanee	*or*	kokanees
ruffe	*or*	ruffes
sculpin	*or*	sculpins
sturgeon	*or*	sturgeons
tilapia	*or*	tilapia

Appendix D. *Geographic and Geological Terms*

The list below shows the treatment of geographic and geological terms that are encountered frequently in AFS publications. For the treatment of other terms, see *Webster's New Geographical Dictionary* or contact the Journals Department.

Alaska Peninsula
the Arctic
Atlantic coast
Atlantic Continental Shelf (Slope)
Atlantic Shelf

basin (e.g., Appalachian basin)

California Current
Canadian government
Canadian Shield
a coastal plain
a continental shelf (slope)

Deep South
the Delta (Mississippi)
driftless area

East Coast
eastern
Eastern Shore (Maryland)
eastern United States (*not* the East)
Equatorial Current

Fall Line
fault (e.g., San Andreas fault)

Glacier (e.g., Columbia Glacier)
Grand Bank(s)
Great Basin
Great Plains
Gulf Coast (as region)
Gulf Stream

The Hague
Hawaiian Islands

Inner Coastal Plain

Laurentian Shield
Lock 19 (Mississippi River)
lower Colorado River

massif (e.g., Adirondack massif)
mid-Atlantic region
Mid-Atlantic Ridge
Middle Atlantic Bight
the Midwest
Midwestern
Mille Lacs
Mississippi Delta
Mississippi River delta

The Netherlands
North Atlantic
north-central
the Northeast
northeastern
northern
northern United States (*not* the North)
North Shore (Gulf of St. Lawrence)
north shore (Lake Superior)
the Northwest
northwestern

Oregon Coast Range
Outer Coastal Plain

Pacific coast
the Pacific Northwest
Philippines (*not* the Philippines)
the Piedmont
Pool 12 (Mississippi River)

Province of Ontario

Sacramento–San Joaquin Delta
Sacramento–San Joaquin Estuary
San Francisco Estuary
the South
South Atlantic Bight
south-central
the Southeast
Southeast Alaska
southeastern
southern
Southern California Bight
the Southwest
southwestern

state of Washington
syncline (e.g., Murphy syncline)

upper Mississippi River
Upper Midwest
Upper Peninsula (Michigan)
U.S. Government

Washington State
West Coast
West Florida
western
western United States (*not* the West)
Windward Islands

NOTE ON GEOLOGICAL TERMS

Formal geological terms are capitalized except for words that are purely descriptive:

Morrison Formation Laurentian Shield

but Ozark uplift Merrimack River basin

The modifiers accompanying the following terms, which refer to periods, systems, epochs, or series, are capitalized (e.g., Upper Cambrian, Late Eocene):

Cambrian Cretaceous Devonian Jurassic Mississippian Ordovician Pennsylvanian Permian Silurian Triassic Eocene Miocene Oligocene Paleocene Pliocene Precambrian

The names of major divisions, provinces, and sections are also capitalized:

Interior Plains Great Plains Missouri Plateau