

## TRANSACTIONS OF THE AMERICAN FISHERIES SOCIETY

### Guide for Authors

#### Editorial Policy

We encourage submission of original, high-quality, English-language works in fisheries science to the *Transactions*. Broadly construed, fisheries science includes genetics, physiology, biology, ecology, population dynamics, economics, health, culture, and other topics germane to marine and freshwater finfish, exploitable shellfish, and their respective fisheries. We judge papers for their scientific competence, for their integration with existing knowledge, and for their contribution to our understanding of basic principles.

Generally, we favor works that address functional questions (How? Why? When?), but we appreciate that many aspects of fisheries science still lack a basic descriptive foundation (What? Where? How much?). Descriptive papers relevant to an understanding of functional processes are acceptable, particularly if they are based on comparative research (among species, habitats, etc.).

We do not proscribe any subject within fishery science, but as the preceding remarks suggest, some treatments of a topic are more appropriate for the *Transactions* than others. For example, we will consider a good paper on fish systematics, but not a taxonomic one; a biogeographic analysis, but not a report of range extensions. Papers devoted wholly to new techniques should clearly advance the research capabilities within a discipline; equipment modifications and minor analytical innovations usually can be presented within a full scientific report. Baseline data, faunal surveys, anatomical anomalies, and other raw data or curiosities should be withheld from the *Transactions* until scientific inferences can be drawn from them. Papers dealing with management applications of fisheries science are often more appropriate for our companion publication, the *North American Journal of Fisheries Management*. Papers on practical aquaculture may be submitted to the *North American Journal of Aquaculture* (formerly *The Progressive Fish-Culturist*). Papers that address the health of fishes and other aquatic organisms may be submitted to the Society's *Journal of Aquatic Animal Health*.

The *Transactions'* emphasis is on basic and applied research, but we value synthesis and will consider commentary or review papers for publi-

cation. In such papers we will look for critical assessments, innovative interpretations, and distillation of principles and generalities.

We strongly discourage the fragmented reporting of scientific results. Whenever possible, coherent research should be published in a single comprehensive paper. If this is not feasible, we recommend that related papers be coordinated, cross-referenced, and submitted together. Authors should not republish their original data without full attribution and explicit permission; see "Dual Publication of Scientific Information," *Transactions* 110:573–574 (1981).

#### Manuscript Submission and Review

##### *Manuscript Categories*

Manuscripts may be up to 150 pages long (including tables and figures), the equivalent of 50 printed pages. (Longer papers should be submitted as Monographs, for which we require external publishing funds.) Manuscripts may be submitted to any of the following categories. (1) *Articles* comprise full scientific reports and critical reviews. (2) *Notes* are short papers of inherent value but limited scope, brief reports of important but unrefined experiments that the author is unable to repeat (for nontechnical reasons), and observations on methodology and protocol. (3) *Forum* papers, a new category, may be in-depth essays, perspectives, or commentaries on current fisheries topics (see TAFS 127:838). (4) *Comments* are critiques of data and interpretations already published in the *Transactions*, responses to which will be invited from the original authors. We also publish corrections (errata) of papers previously published in this journal.

##### *Submittal Procedures*

Submit new manuscripts and associated correspondence at the journal's online manuscript submission and peer review site: [tafs.allentrack.net](http://tafs.allentrack.net). You may also access the manuscript submission site through the Publications pages on the American Fisheries Society's Web site ([www.fisheries.org](http://www.fisheries.org)). On your first visit to the journal site, you will need to register for an account. If you have completed the expert database form on the Society's Web site, you may already have an account.

In that case, your login name and password will be sent to you by e-mail during the registration process. This login name and password can be used on all of the Society's journal submission sites; there is no need to register again for each journal. You will be able to submit text, tables, and figures online. More detailed instructions, including acceptable file formats, are available on the site.

Publication charges are US\$75 per printed page and will be billed when the paper is in proof. Partial or full subsidy of page charges may be provided to voting members of the American Fisheries Society (only) who certify that grant or agency funds are severely limited or unavailable. Manuscript reviews are unaffected by requests for subsidy; however, at least one author of a subsidized paper must be or must become a member of the Society *before* a subsidized paper can be published. Every paper published in the journal is subject to a \$30 fee to offset handling costs associated with the proof. Authors may purchase reprints of their papers from the printer when they receive their proofs.

#### Review Process

Articles and notes normally will be critically reviewed by at least two outside experts in the relevant discipline. However, we may return to authors without review any manuscript that we judge to be of low technical or rhetorical quality or simply inappropriate for this journal. Reviewers and authors have the option of anonymity. Authors who wish to exercise this option should structure their manuscripts accordingly.

Because the review process depends on volunteers, it sometimes can be a lengthy process; however, we strive to get evaluations of well-written papers back to authors within 8–12 weeks after submission. Authors should do their part by revising papers promptly, ideally within 3 months of the time the paper is evaluated by the editor. Papers that have been out for revision for 6 months or more will be considered withdrawn, and revisions completed after that time will be considered new submissions.

Reviewers (and editors) react positively to concisely written and well-organized papers and are likely to give such papers priority attention. Careless preparation of manuscripts implies careless research and thought and may lead to negative critiques. Authors can greatly help their own cause if they (1) write direct, unambiguous, grammatically correct prose and avoid redundancy and wordiness; (2) clearly establish the intellectual

context and practical or theoretical importance of their work; (3) provide all methodological information needed to understand and interpret their results, without unnecessary details; (4) prevent statistical or analytical sophistication from upstaging biological insight; (5) integrate their results broadly but relevantly with the published literature; (6) forgo trivia and unwarranted speculation; and (7) follow the journal's style and format.

Authors for whom English is not their primary language are strongly encouraged to seek help from someone for whom it is when they prepare their papers for submission to the journal.

#### Preparation of Manuscripts

Our standard for word definition and spelling is *Webster's Third New International Dictionary*, as updated by the latest edition of *Merriam Webster's Collegiate Dictionary*.

For taxonomic and vernacular names of North American fish species, we follow the American Fisheries Society's most recent edition of *Common and Scientific Names of Fishes from the United States, Canada, and Mexico*. For other fish and invertebrate species, we encourage readers to follow the Society's companion publications: *World Fishes Important to North Americans* and *Common and Scientific Names of Aquatic Invertebrates from the United States and Canada (Mollusks, 2nd edition, Decapod Crustaceans, and Cnidaria and Ctenophora)* are currently available in the latter series). Common names sanctioned by these lists may be used freely in this journal, but they must be accompanied by their respective scientific names when first mentioned in the abstract and text. Always use full common names: "largemouth bass," not "bass." Some plural forms of common names differ from the singular forms; consult a dictionary.

For analyses of fish population dynamics, we prefer the notation as used by W. E. Ricker in his *Computation and Interpretation of Biological Statistics of Fish Populations* (Fisheries Research Board of Canada Bulletin 191, 1975). However, all such symbolism should be defined anew in each manuscript. Our standards for chemical names are the current editions of the *Merck Index* (Merck & Co., Rahway, New Jersey) and *Enzyme Nomenclature* (Academic Press, San Diego, California). Geneticists should use the "Gene Nomenclature for Protein-Coding Loci in Fish" by J. B. Shaklee et al. (*Transactions of the American Fisheries Society* 119:2–15, 1990).

*Writing for Fishery Journals*, edited by John Hunter (1990, American Fisheries Society), contains an excellent chapter on graphic and tabular display of data; other chapters provide advice about statistical and word usage. An extensive style guide for AFS publications is available on the AFS Journals page of the Society's website ([www.fisheries.org](http://www.fisheries.org)). In addition, several other style manuals provide useful guidance for the preparation of manuscripts, among them are the latest editions of *Scientific Style and Format* (Council of Biological Editors, Chicago), and the *Chicago Manual of Style* (University of Chicago Press, Chicago). The *Elements of Style* by Strunk and White (Macmillan, New York) continues to be an excellent guide to English usage. Accuracy and precision in scientific writing are just as important as accuracy and precision in scientific measurement. Lapses in either context invite criticism.

#### *Format Conventions*

Whenever authors follow the style and format of the journal for which they write, they earn the appreciation of reviewers, editors, and typesetters, and save themselves extra revisionary work. The following conventions apply to this journal.

(1) Use line spacing of at least 1.5 for all material, including title, abstract, footnotes, references, tables, and table and figure legends.

(2) Enable continuous line numbering for all manuscript pages. Number all pages sequentially, including title page, abstract, tables, and figure legends. Make sure that headers or footers will not be confused with the text.

(3) Use a standard 12-point font throughout. Use boldface type only to indicate first-level heads and vectors. Use an italic font and not underlining to indicate italics.

(4) Turn off all hyphenation and justification routines. Delete all horizontal and vertical lines from tables except the horizontal lines above and below the column heads and across the bottom of the table.

(5) Avoid solid capital letters except for acronyms, which, along with abbreviations and symbols (including numerals), should never begin a sentence. Use an italic font only for scientific binomials (other Latin words and phrases are *not* italic), second- and third-level subheadings, single-letter variables and constants in mathematics and statistics, and for *occasional* emphasis.

(6) Spell out one-digit numbers unless they are used with units of measure or are directly compared with a larger number: four anglers; 5 cm; 8

bluefish and 16 striped bass. Use numerals for decimal fractions and numbers of two or more digits: 0.4 times; 17 tanks; 326 fish, but spell out any number that begins a sentence. Use commas in numbers of 1,000 and greater; use 0 before decimal fractions (0.05).

(7) Use the 24-hour clock for diel time (and spell out "hours"): 1435 hours, not 2:35 p.m. Calendar dates can follow either of two formats: day month year (17 July 1990) or month day, year (July 17, 1990); select one style and use it consistently throughout the paper, including Tables and Figures.

(8) Follow the name-and-year system for literature citations (see References below).

(9) Keep text footnotes to a minimum and number them sequentially throughout the paper. Table footnotes take lowercase, superscript letters in alphabetical order, and the sequence starts anew with each table.

(10) Use metric units of measure without exception. Report physical measurements in accordance with the *Système International d'Unités* (SI). When one unit appears in a denominator, use a solidus (6 mg/L); use negative exponents and product dots ( $26.4 \text{ g}\cdot\text{m}^{-3}\cdot\text{h}^{-1}$ ) for compound denominators.

(11) Indicate the national currency involved the first time a monetary value is given (e.g., Can\$6, US\$153).

(12) Give fish ages in Arabic, not Roman, numerals (age 3, not age III) and avoid plus (+) signs in the age notation. A fish is age 0 during its first year of life, which is assumed to end December 31 unless otherwise indicated. Define specialized age notations such as those used for anadromous species.

(13) A list of symbols and abbreviations that may be used without definition in this journal is provided at the end of this "Guide for Authors." Some symbols are not unique (for example, N can mean newton, nitrogen, normal, or north), so terms should be spelled out if there is any chance of ambiguity. All other symbols must be defined when they are introduced in each paper; for example, "1,000  $\times$  gravity (*g*)" at first use, and "1,000 *g*" thereafter. To facilitate communication with readers, avoid excessive use of abbreviations and acronyms, and avoid abbreviations in the abstract.

#### *Manuscript Components*

Manuscripts normally should be assembled in this order: title, authors, and addresses (on one page); abstract (on the second page); introduction,

study area, methods, results, discussion, acknowledgments (run-in on successive pages); references; all text footnotes (including address changes); appendixes; tables; figure captions; figures. The following notes expand on these items.

*Title.*—The title should accurately reflect a paper's content. The best titles—those that attract a reader's attention and interest—are usually short (a dozen words or less) and crisp. Latin binomials covered in the Society's *Common and Scientific Names of Fishes from the United States, Canada, and Mexico* should not be included in the title. Authors of scientific taxa also should be omitted from the title except when their names are absolutely needed for clarification.

*Abstract.*—All articles and notes require abstracts, but comments do not. The abstract should be a single paragraph of 200–300 words (75–200 words for notes) that summarizes the results and conclusions in concise and declarative prose. Abstracts should neither list the contents (this is presented; that is discussed) nor review the methods. Literature citations and footnotes are not allowed in abstracts. Abstracts obviate the need for formal text summaries. Because they are widely circulated by abstracting services, abstracts have much larger readerships than do full papers, and the abstract should represent the text fairly and accurately.

*Introduction.*—An introduction should set the context for the work to be reported and establish the purpose and importance of that work. It also should demonstrate the authors' awareness of the most pertinent literature, including review articles. However, a comprehensive literature survey may be deferred to the discussion section if this is more appropriate.

*Study site.*—A report of field studies may need a detailed site description, which can be given in a separate section of the manuscript. Limit the information to that needed for an understanding and interpretation of the results. If only a few words are needed to locate and describe the study site, include them in the introduction or methods. Maps are unnecessary if they only give information contained in standard atlases.

*Methods.*—Methodologies can be tedious to read, but it is better to be overly explicit than to omit details needed by a reader to evaluate the data or repeat the study. Previously published descriptions of equipment and procedures may be cited by reference, unless they are in theses, dissertations, agency reports, or other sources of limited availability. Clarity of expression is as im-

portant in the methods section as it is elsewhere in the paper. If the experimental protocol and equipment are particularly complex, they can be displayed in a table or figure. Similarly, the numerous variables needed for some mathematical developments may be listed and defined in a table.

Long papers that report diverse research may benefit if methodological details are split up and regrouped together with the respective results. This can help the reader to associate the data with the respective procedures. In such cases, a formal methods section can be restricted to matters common to all or most of the experiments: sources of fish, equipment, chemical analyses, or statistical tests, for example.

Some papers, such as those concerned wholly with techniques or models, as well as review articles, may need no separate methods section.

*Results.*—Results traditionally follow methods, and need not be explicitly labeled as such if a more descriptive subheading is available. If results are presented in tables or figures, it is pointless to describe them exhaustively in prose as well; the text can be devoted to summary statements and analyses. Display data in tables if precision is important, in figures if trends are paramount. Although long lists of raw data are undesirable, basic data should not be refined to the degree that a reader can neither verify the analyses nor use the information for other purposes. Statistical testing is an important part of most analyses, but it should not obscure biological insight. Most importantly, the statistical designs and models used should be appropriate for the study. Many criticisms of fishery work address statistical flaws; consult experts as necessary. Although most scientific decisions are based on a statistical probability of error of 5% or less, we have no requirements regarding significance levels. Decision probabilities should balance the sacrifice of biological information against the consequences of being wrong.

*Discussion.*—The value of a paper can be greatly enhanced by a good discussion. This is the place to relate what has been learned to what is known, to create new syntheses, to search for generalities, to establish basic principles. The weakest discussions are brief literature surveys appended to mechanical restatements of the results; these usually should be integrated with the results in a single section of the paper. The strongest discussions are true scientific essays that materially advance understanding of their respective fields, whether they concern fishing mortality or ecosystem function.

Most discussions fall between these extremes because they are founded on limited research objectives, but a thoughtful and scholarly discussion can transform a pedestrian paper into a remarkable one.

The quality of a discussion is inversely related to redundancy, wordiness, and unfounded speculation. It is better not to make a point than to burden it with a paragraph of qualifications. The work of others, when cited, should be attributed carefully and accurately. Transitions from evidence to intuition need explicit identifications.

*Acknowledgments.*—Place grant and contribution numbers in the acknowledgments. Acknowledge only people and institutions that contributed directly to the research or to the manuscript's quality. The psychic support of spouse, family, and friends can be rewarded in other ways.

*References.*—Select references with caution. We will not allow reference to progress reports, to unpublished papers or abstracts of papers given at conferences, or to manuscripts in preparation or under review—except to acknowledge (in the acknowledgments section) intellectual debt. Although theses, dissertations, final reports, and institutional documents of limited or no circulation often contain useful data and may be cited, such sources rarely have been subjected to external review and should be cited sparingly. Authors may be requested to provide unpublished reports if they are required by the referees. Reliance on unpublished reports reduces an author's credibility. If unpublished data or personal communications must be cited, do so parenthetically in the text, giving initials, surname, and affiliation (not address) of the source; for example, (A. B. Jones, Institute for Aquatics, personal communication). Obtain written permissions from the appropriate people to cite unpublished data and personal communications, and be prepared to show such letters to the editor.

Literature citations in the text take either of two forms, depending on the context. Note the punctuation in the following examples.

(1) Johnson (1995), Jones and Smith (1996, 1998), Rice et al. (1997), and Berger (in press) found walleyes in Lake Pollock.

(2) Walleyes occur in Lake Pollock (Johnson 1995; Jones and Smith 1996, 1998; Rice et al. 1997; Berger, in press).

Cite both of two authors, but for three or more give only the first author plus "et al." Arrange multiple citations chronologically (oldest first) in a text sentence.

If their names are long, institutional authors may

be cited as acronyms in the text, but such acronyms must be defined in the references. For example, "APHA et al. (1992)" cited in the text appears in the reference list as "APHA (American Public Health Association), American Water Works Association, and Water Environment Federation. 1992." Cite "in press" for papers accepted for, but still awaiting, publication.

In the reference list, alphabetize entries first by the surnames of first authors or by the first word or acronym of corporate authors, then by the initials of first authors with the same surname, and finally by the surnames of coauthors. List multiple papers by the same author(s) chronologically by year of publication. Distinguish papers by the same author(s) in the same year by lowercase letters after the year (1998a, 1998b). Substitute "in press" for the year if a paper has been accepted for publication but page numbers are not yet available.

Completely spell out all bibliographic information, including serial titles. We allow only these abbreviations:

- (1) first and middle initials of authors and editors;
- (2) abbreviations that occur in the titles of articles and books and in the names of authors;
- (3) ordinal numbers (2nd edition, 4th congress) other than those spelled out in titles.

Examples of common bibliographic formats follow.

(1) Articles in journals and other periodicals listed in *BIOSIS Serial Sources* (BIOSIS, Philadelphia), but see exception for AFS book series in (3) below: author(s); year; title; serial; volume; issue (if needed); inclusive pages. Include the issue number only when each issue starts with page 1.

Crawshaw, L. I., D. E. Lemons, M. Palmer, and J. M. Messing. 1982. Behavioral and metabolic aspects of low-temperature dormancy in the brown bullhead, *Ictalurus nebulosus*. *Journal of Comparative Physiology B* 148:41–47.

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.

Kent, M. L., G. S. Traxler, D. Kieser, J. Richard, S. C. Dawe, R. W. Shaw, G. Prosperi-Porta, J. Ketcheson, and T. P. T. Evelyn. 1998. Survey of salmonid pathogens in ocean-caught fishes in British Columbia, Canada. *Journal of Aquatic Animal Health* 10:211–219.

(2) Book: author(s); year; title; edition (other

than 1st) or volume (if part of a series); publisher; city; state, province, or country (only if needed to locate city). Omit the number of pages.

APHA (American Public Health Association), American Water Works Association, and Water Environment Federation. 1992. Standard methods for the examination of water and wastewater, 18th edition. APHA, Washington, D.C.

Hoar, W. S., and D. J. Randall, editors. 1988. Fish physiology, volume 11, part B. Academic Press, New York.

Rheinheimer, G. 1985. Aquatic microbiology, 3rd edition. Wiley, New York.

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

(3) Article in a book (including those in the AFS “serial” books—Special Publications, Symposia, and Monographs): author(s); year; title; inclusive pages; editor(s); book title; publisher; series name (if appropriate); city; state, province, or country (only if needed to locate city). Identify conference proceedings by year of publication, *not* by the year of the meeting, and give the publisher’s name and location (i.e., where the proceedings may be obtained), *not* the location of the meeting.

Adams, S. M., and J. E. Breck. 1990. Bioenergetics. Pages 389–415 in C. B. Schreck and P. B. Moyle, editors. Methods for fish biology. American Fisheries Society, Bethesda, Maryland.

Campton, D. E. 1995. Genetic effects of hatchery fish on wild populations of Pacific salmon and steelhead: what do we really know? Pages 337–353 in H. L. Schramm, Jr. and R. G. Piper, editors. Uses and effects of cultured fishes in aquatic ecosystems. American Fisheries Society, Symposium 15, Bethesda, Maryland.

Livingstone, A. C., and C. F. Rabeni. 1991. Food-habitat relations of underyearling smallmouth bass in an Ozark stream. Pages 76–83 in D. C. Jackson, editor. The first international smallmouth bass symposium. Mississippi Agriculture and Forestry Experiment Station, Mississippi State University, Mississippi State.

(4) Dissertation or thesis: author; year; title; dissertation; university; city; state, province, or country (only if needed to locate city).

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.

(5) Government publication: author(s) or agency; year; title; agency; type and number of publication; city; state, province, or country (only if needed to locate city).

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

Gimbarzevsky, P. 1988. Mass wasting on the Queen Charlotte Islands: a regional inventory. British Columbia Ministry of Forests and Lands, Land Management Report 29, Victoria.

(6) Contract report: author(s); year; title; organizations that issued the report (if different from the author); organization that received the report; receiver’s city; state, province, or county (only if needed to locate city).

Smith, A. B. 1986. Turbine-induced fish mortality at Highrise Dam, 1985. Report of Robertson Consultants to Prairie Utilities, Jonesville, Alberta.

(7) Internet citations: author(s) or agency; year; title; publisher; URL; month and year accessed.

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. Available: [www.glfsc.org/databases/commercial/commerc.asp](http://www.glfsc.org/databases/commercial/commerc.asp). (September 2000).

Note that only the first words and proper nouns of English titles are capitalized. In German titles, all nouns are capitalized. Retain italics when they are used in the titles cited.

*Footnotes.*—Bring all text footnotes together after the references. Keep them to a minimum. Typical footnotes give address changes for authors, availability of supplementary data, and disclaimers of product endorsement. Most other material, including personal communications (which also should be minimized), can be included in the text or the acknowledgments.

*Tables.*—Organize tables to convey the greatest amount of coherent information with the least amount of wasted space and redundancy. One practical constraint is the width of a journal’s printed column or page (69 mm and 143 mm, respectively, in this journal). If necessary, we will split wide tables across facing pages. We do not print tables broadside (landscape) on the page; however, tables may be printed in landscape format for review purposes. In most cases, problems of space can be minimized if a table is oriented such that the number of columns is less than the number of rows. Even within these constraints, it frequently

is possible to combine small but related tables into a single concise and definitive statement.

Place a zero to the left of the decimal point for fractions smaller than one. Pay attention to the number of significant digits, regardless of what a computer may have printed out. Although fractions of a percent may be statistically justified in some cases, they rarely convey more meaning in fisheries work than do rounded, whole percentages.

Use the table caption or footnotes to identify nonstandard symbols and abbreviations. Footnotes take lowercase letter superscripts, which occur in alphabetical order. List footnotes below the table.

In column and row headings, capitalize only the first word, proper nouns, and appropriate symbols. Horizontal ruled lines seldom are needed in the body of tables, and vertical lines are never allowed. Use line spacing of at least 1.5 for the caption and entries and continue the table on additional pages, if necessary. *Do not* reduce type size for tables.

*Figure captions.*—List all figure captions sequentially on one or more pages. Identify in the captions all symbols that are not standard or defined on the figures, and include full disclosure whenever digital images have been electronically manipulated or enhanced.

*Figures.*—Print photographs on glossy paper with good contrast; place symbols and scale bars so they are at least 4 mm inside the outer edges of a photograph. We will not accept xerographic copies of figures or typewritten figure labels for publication. When the substitution is feasible, we prefer line drawings to halftone illustrations. Color

photos will be printed in black and white unless the author has made prior arrangements with the Journals Manager to cover the additional cost of color printing.

Labels should describe the *x*- and *y*-axes clearly. Place the *y*-axis label to the left of the axis and orient it to read sideways from bottom to top of the graph. Photomicrographs may be reduced during printing and should contain a scale bar directly on the photograph; give the equivalent length either on the bar or in the figure caption.

Most line drawings can be adequately reproduced in a single column of this journal (69 mm wide) if the lettering and data symbols are sufficiently large. All letters should be at least 1.5 mm high (or 6-point type) after the figure is reduced; avoid bold fonts. A figure that is 20 cm wide when drawn can reduce to one column if the smallest original lettering is at least 4.5 mm high (18-point type). Letter size and line thickness (including axes) should vary no more than twofold on a figure. Figure reduction can cause symbols and shadings to look alike, dashed lines to become continuous, and dotted lines to disappear, so choose elements that will retain their clarity and contrast when reduced and published. Keep graphics simple and uncluttered. Avoid unnecessary use of three-dimensional charts, black borders, and shaded fill. If shaded fill *is* used, keep it in the range of 30–70% of black for best reproduction. Keep blank space to a minimum by placing axis labels near the axes, multiple panels close together, and “outlier” words (compass directions, scale bars, keys) within the margins of the figure. Carefully planned figures enhance a paper’s message and can reduce authors’ publication costs.

### Symbols and Abbreviations

The following symbols and abbreviations, as well as others approved for the Syst me International d'Unit s (SI) are used in *Transactions* without definition. All others must be defined at first mention.

<i>Prefixes</i>		minute (angular)	'	molar	M
giga (10 <sup>9</sup> )	G	not significant	NS	mole	mol
mega (10 <sup>6</sup> )	M	percent	%	newton	N
kilo (10 <sup>3</sup> )	k	probability	<i>P</i>	normal	N
milli (10 <sup>-3</sup> )	m	probability of type I error (false rejection of null hypothesis)	<i>P</i> <sub>α</sub> or α	ohm	Ω
micro (10 <sup>-6</sup> )	μ	probability of type II error (false acceptance of null hypothesis)	β	ortho	<i>o</i>
nano (10 <sup>-9</sup> )	n			para	<i>p</i>
pico (10 <sup>-12</sup> )	p			pascal	Pa
<i>Time and Temperature</i>				per mille (per thousand)	‰
day	d	radian	rad	siemens (=mho, Ω <sup>-1</sup> )	S
degrees Celsius	°C	sample size		tesla	T
hour	h	population	<i>N</i>	tris(hydroxymethyl)-aminomethane	tris
(spell out for diel time)		sample	<i>N</i> or <i>n</i>	volt	V
kelvin	K	second (angular)	"	watt	W
minute	min	standard deviation	SD	weber	Wb
second	s	standard error	SE		
Spell out year, month, week.		steradian	sr	<i>General (Some Are Restricted)</i>	
<i>Weights and Measures</i>		variance		compass directions (maps and coordinates):	
centimeter	cm	population	<i>V</i> or Var	east	E
deciliter	dL	sample	var	north	N
gram	g	<i>Physics and Chemistry</i>		south	S
hectare	ha	all atomic symbols		west	W
kilogram	kg	alternating current	AC	corporate suffixes:	
kilometer	km	ampere	A	Company	Co.
liter	L	becquerel	Bq	Corporation	Corp.
meter	m	calorie (joule is preferred)	cal	Incorporated	Inc.
Spell out metric ton.		candela	cd	Limited	Ltd.
<i>Mathematics and Statistics</i>		chemical acronyms listed in Webster's dictionaries (DDT, EDTA, etc.)		District of Columbia	D.C.
all standard mathematical signs, symbols, and abbreviations		coulomb	C	et alii	et al.
base of natural logarithm	<i>e</i>	dextro configuration	D	et cetera	etc.
common test statistics ( <i>F</i> , <i>t</i> , etc.)		dextrorotary	<i>d</i>	filial generation	F
correlation or regression coefficient (multiple)	<i>R</i>	direct current	DC	for example	e.g.,
correlation or regression coefficient (simple)	<i>r</i>	electron volt	eV	international unit	IU
covariance	cov	equivalent	eq	months (in tables, figures):	
degree (angular)	°	farad	F	first three letters	
degrees of freedom	df	gray	Gy	(e.g., Feb, Jun, Sep)	
expected value	<i>E</i>	hertz	Hz	ploidy	n
logarithm (specify base)	log	hydrogen ion activity (negative log of)	pH	sex (in tables, figures, hybrid crosses):	
		joule	J	female	♀
		levo configuration	L	male	♂
		levorotatory	<i>l</i>	that is	i.e.,
		lumen	lm	United Kingdom	UK
		lux	lx	United States (adjective)	U.S.
				United States of America (noun)	USA